THE LARYNGOSCOPE

AN INTERNATIONAL MONTHLY JOURNAL
ON DISEASES OF THE

EAR-NOSE-THROAT

VOLUME LIX—JANUARY-DECEMBER 1949

FOUNDED IN 1896 BY
DR M A GOLDSTEIN, ST LOUIS
DR. THEO E WALSH, ST LOUIS
EDITOR

PUBLISHED BY THE LARYNGOSCOPE
640 SOUTH KINGSHIGHWAY - ST LOUIS (10), MO, U S A

GLYKERON
FOR
COUGH

SEDATIVE • • EXPECTORANT

Codeine and hyoscyamus plus ammonium hypophosphite, white pine and tolu in a glycerin base provide sedation of the cough reflex—liquefy mucus General dosage Adults 1 to 2 teaspoonfuls every 2 to 3 hrs Children in proportion Literature and samples available to physicians only Narcotic registry number required

MARTIN H. SMITH COMPANY
150 LAFAYETTE STREET - - - NEW YORK 13, N Y

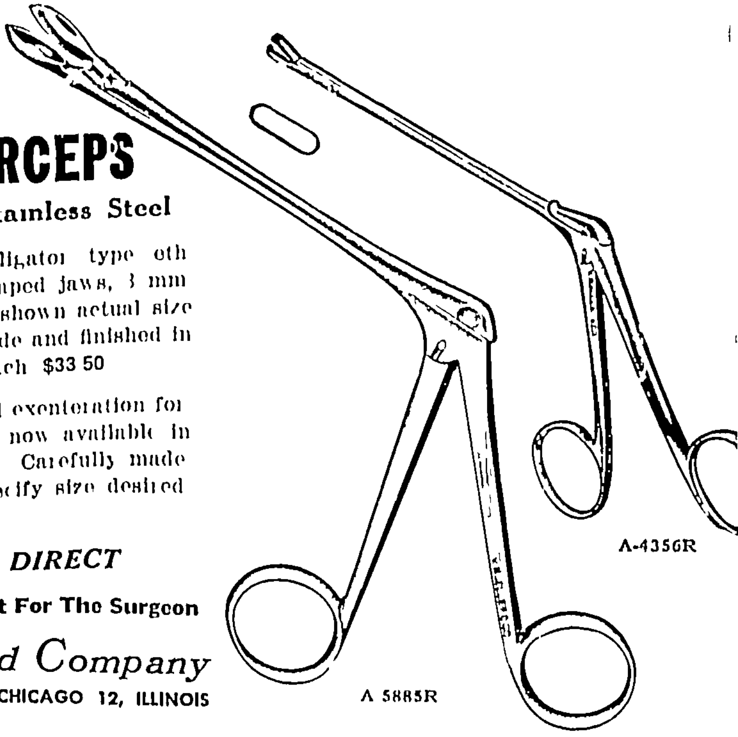
Wildes and Takahashi
ETHMOID FORCEPS
Finest Quality — Stainless Steel

A 4356R TAKAHASHI alligator type ethmoid forceps, with cup shaped jaws, 3 mm x 10 mm Take a bite as shown actual size in the inset Precisely made and finished in durable stainless steel Each $33 50

A 5885R WILDE'S ethmoid exenteration forceps The straight model now available in two sizes, small and large Carefully made stainless steel Please specify size desired Each $33 50

ORDER YOURS DIRECT

For All That's Best For The Surgeon
V. Mueller and Company
408 S HONORE ST CHICAGO 12, ILLINOIS



THE
LARYNGOSCOPE.

VOL LIX JANUARY, 1949 NO 1

AUTONOMIC DYSFUNCTION IN THE INNER EAR*

JEROME A HILGER, M D ,
St Paul, Minn

The autonomic nervous system is the mediator in the body's adjustment to its environment The character of one's autonomic system is a matter of inheritance There is variation in the quality and performance of the system in different individuals This fact has been a matter of medical record since early times and was given particular impetus by the writings of Eppinger and Hess,[1] who, in 1909, introduced the clinical pictures of the sympatheticotonic individual and the vagotonic individual into medical literature It is interesting to follow the emergence of the autonomic system from the anatomic awareness of the nineteenth century to its present position in the forefront of functional clinical medicine Diseases then recognized and described only in the textbooks of morbid anatomy are now recognized and intercepted in the stage of early altered physiology — the stage in which autonomic dysfunction has not yet been translated into permanent tissue change The era of bacterial supremacy in disease concepts appears to be giving way to a realization that intrinsic bodily dysfunction in the neurovascular, neurosecretory and neuromuscular mechanisms may be of more importance in many previously obscure disorders than the presence of bacteria of dubious pathogenicity The focal disease theory shrinks into relative insignificance as one bodily disorder

---

*Read at the Annual Meeting of the American Academy of Ophthalmology and Otolaryngology Chicago Ill October 1948

Editor s Note This ms received in Laryngoscope Office and accepted for publication Nov 1 1948

after another, previously ascribed to it, is demonstrated to result from autonomic dysfunction The emphasis of recent years on psychosomatic medicine is an expression of general medical awareness of the impact of man's environment on a neural mechanism which may not be equal to a smooth performance of its task

The inner ear is a structure well designed anatomically to give gross symptomatic expression to very minor alterations in its neurovascular and, perhaps, neurosecretory mechanisms Few end-organs in the body are as expressive of minute changes of autonomic control The inner ear is a rigidly closed space Circulation is supplied by an end-artery and its branches Collateral circulation is absent The neural mechanisms dependent upon this arterial supply are minute and delicate Extremely fine vascular change results in relatively severe subjective sensory disturbance These may be of an acoustic nature, a static nature, or both, dependent upon the arterial branch involved

The main artery is the internal auditory, a branch of the basilar Its ramifications supply all parts of the labyrinth A noteworthy branch, the vestibulocochlear artery, carries blood to the basal turn of the cochlea and to a portion of the saccule, utricle and posterior ampulla of the vestibule Vascular tonus in these arterial branches and their arterioles is controlled by the autonomic innervation of the inner ear

The autonomic nervous system is a motor mechanism comprised in reality of two opposed systems which maintain the equilibrium of the organism's adjustment to its environment — the one is the sympathetic system, the other the parasympathetic Sympathetic innervation of the labyrinth arises from the thoracic cord and extends cephalad in the cervical sympathetic trunk and its continuation, the internal carotid nerve The inferior caroticotympanic branch of the latter traverses the bony septum between the carotid canal and middle ear It is here joined by a branch of the IXth cranial nerve, which may contain parasympathetic elements, and the ramifications of the two on the promontory of the middle ear are termed the tympanic plexus

The tympanic nerve which emerges from the tympanic plexus traverses the middle fossa surface of the petrous portion of the temporal bone as the lesser superficial petrosal nerve By connections of the latter with the geniculate ganglion, as well as by direct connecting fibres from the tympanic plexus to the geniculate ganglion and VIIth nerve sympathetic fibres from the cervical trunk and possible parasympathetic fibres from the IXth cranial nerve reach the VIIth The VIIIth nerve, or cochleovestibular nerve carries few autonomic nerve fibres from the brain stem Yet, as shown by Lorente de No[2] this nerve does have such fibres when it ramifies to the cochlear and vestibular end-organs in the fundus of the internal auditory canal A connecting nerve filament which carries these autonomic fibres from the VIIth to the VIIIth cranial nerve in their course in the internal auditory canal was demonstrated by de No in 1925 It completes the anatomic basis for the neurovascular syndromes of the inner ear

There is little known about the effect of increased parasympathetic tonus in the inner ear It is possible that it controls neurovascular phenomena through vasodilator activity and produces common clinical pictures The usual experimental study has been done, not by stimulation of the parasympathetic as a dynamic vasodilating force, but rather by destruction of the sympathetic innervation to produce that effect passively Direct sympathetic stimulation has been carried out repeatedly A mass of experimental work has followed three general lines

1 Cervical sympathectomy and stimulation of the sympathetic at the cervical trunk or below

2 The effects of drugs acting on the autonomic system

3 The results of operations upon man with and without ear disease

Fraser[3] has summarized the work

"The results are somewhat conflicting, but the conclusion which emerges is as follows constriction of the labyrinthine vessels leads to an increase in the excitability of the vestibule Dilatation of these vessels leads to a diminution in the excitability of the vestibule with an increase in the acuity of hearing" The important clinical fact is that the changes in vascular tonus and the resultant changes in fluid balance within the endolymphatic system are produced by dynamic forces and not by static influences of ionic concentrations through semipermeable membranes

One inherits his autonomic nervous system If it be an unstable one, the potentiality toward certain clinical disorders is great The impact of the environment results in manifestations of autonomic imbalance in many body systems The mechanism is sometimes set in motion by single, specific effectors, such as foods or inhalant substances and the body system involved becomes established as a shock organ which thereafter may react to those substances independent of central neural controls The clinical picture of allergy results Often, and particularly in a vigorous climate, physical factors of temperature and humidity and their rapid alteration will produce these striking autonomic effects The result has been spoken of as physical allergy and sometimes as intrinsic allergy

There remains yet another effector, and more important perhaps than extrinsic food, inhalant or physical factors, which can produce marked clinical disorder through autonomic disturbance That effector is the individual's own emotion This factor brings confusion to the ordinary concepts of allergy It is the effector in a high percentage of the neurovascular, neurosecretory and neuromuscular reactions which make up the picture of the intractable, or fixed allergic

Autonomic dysfunction in the inner ear comes under the influence of these effectors In the same individual, one or all may be capable of producing the clinical syndromes of the inner ear Foods and inhalants are of least importance The inner ear is not commonly their shock organ The individual who develops tinnitus, vertigo and hearing impairment from a specific food or inhalant is uncommon enough to be worthy of remark Physical factors have more significance Tinnitus is more commonly noted during periods of inclement weather and changes of season Vestibular vertigo, with or without cochlear symptoms, is more frequently seen during the same periods These, however, are observations that are difficult to demonstrate statistically because the individual who is truly physically sensitive is usually also most subject to emotional effects through the same autonomic mechanism, and emotional stress knows no season

Williams[4] organized the many autonomic imbalances of the head into the picture of intrinsic allergy of the head One patient may manifest neurovascular and neurosecretory irregularities in many systems In the head, Williams has grouped these into myalgias, vasodilating pains, chronic vasomotor rhinitis and endolymphatic hydrops

The terminology of the inner ear syndromes is confusing It has run the gamut from Ménière's disease to endolymphatic hydrops and from catarrhal deafness to endolymphatic hydrops without vertigo In order that all degrees of autonomic dysfunction in the inner ear be given a common etiologic term, it would seem preferable to denote the disturbance as vasomotor labyrinthitis where all components of the inner ear are involved, and vasomotor cochlearitis or vasomotor vestibulitis where only acoustic or only static components have yet been involved

The changes in neurovascular tonus may be precipitate and extreme or they may be of minor degree and long continued The cataclysmic disorder of major neurovascular involvement was organized into a syndrome by the writings of Ménière The chronic progressive degeneration of long continued minor neurovascular change has been obscured as catarrhal deafness or primary VIIIthe nerve neuritis for several medical generations The altered physiology producing both pictures differs not in character but in degree

Careful history demonstrates that in 80 per cent of patients a premonitory phase precedes a first violent inner ear attack. This phase may last for years and be characterized only by intermittent tinnitus, with or without gradually developing hearing impairment, or by mild, transient vertigo, elicited only by abrupt positional change These symptoms are evidences of poor autonomic adjustments in the neurovascular control of the inner ear At this stage of the disorder the majority of patients will evidence other symptoms of cranial autonomic instability, in the form of myalgia, vasodilating pain or chronic vasomotor rhinitis, or in a positive family history of similar parental or sibling involvement In fact, the associated vasomotor rhinitis and pain phenomena have been so commonly noted in association with these ear symptoms in past decades that the misnomer of catarrhal deafness became descriptive of the chronic progressive cochlear degeneration which resulted from vasomotor cochlearitis The inept practice of auditory tubal inflation became a standard otologic procedure It is embarrassing to reflect today on the hundreds of thousands of middle ear inflations in which otologists have doggedly indulged in an effort to relieve by aerodynamics a disorder which in reality results from neurovascular disturbance in the inner ear

Most patients with inner ear symptoms from faulty autonomic balance never manifest the complete syndrome of inner ear disruption All are potential candidates, however The first appearance of tinnitus or of vertigo on quick alteration of position in a patient with associated evidence of autonomic imbalance or pronounced family history of same marks the individual in the astute clinician's mind It is interesting to follow the vasomotor vagaries of one such individual for several years and see the first complete inner ear syndrome appear suddenly and cataclysmically after a particularly severe environmental stress For every individual who progresses to this point there are scores who continue for years with lesser involvements When the latter concern vestibular arterial branches only, the pseudo-Meniere's syndrome of Dandy or vasomotor vestibulitis is noted in varying degrees of severity When cochlear arterial segments alone are involved the vasomotor cochlearitis results in intermittent or constant tinnitus and progressive and permanent inner ear type hearing impairment If the vestibulocochlear artery from the internal auditory is affected, tinnitus of high pitch, high tone impairment and variable vertigo result

The pathological change in the inner ear which results from vascular alteration can conceivably take two forms, that resulting from frequent minor changes in vessel lumina and that resulting from sudden major alteration in circulation These may differ not at all in mechanism of production but only in degree of involvement Relative to the former, the observations of Guild[5] on the pathology of chronic progressive inner ear deafness are of moment He states

"Normal looking blood vessels are present in our sections in regions with total atrophy of the organ of Corti The fact that the areas of end-organ atrophy are often very sharply circumscribed suggests occlusion of terminal arteries as the cause, we have no histological evidence, however, to support this view The clinical and pathological evidences of systemic vascular disease, as recorded in our tables, also indicate that arteriolosclerosis is not the cause of organ of Corti atrophy" It is probable that recurrent and transient alterations in vessel lumina produce the permanent neural damage without histologically demonstrable vessel change

At the other end of the scale of neurovascular change, the pathology of the complete inner ear syndrome with violent clinical manifestations in acoustic and static spheres was shown first by Hallpike and Cairns[5] and since corroborated by Lindsay[9] and many others They have shown a gross dilatation of the endolymphatic system with destruction of the neural elements This gross transudation and edema can only have formed through dynamic vasomotor change

The mechanism whereby autonomic dysfunction produces these changes is not known In the vasomotor unstable individual of this type, Muller[6] described an inherited tendency for capillary loops to behave in an abnormal manner on exposure of the organism to physical and emotional stimuli Spasm at the arteriolar end of the capillary results in endothelial change with increase in permeability and the formation of edema The observations of Abell and Schenck[7] have contributed further support to the arteriolar spasm theory of edema formation These changes can be mediated through autonomic innervation

Drugs possessing the ability to block central autonomic influence have favorable effect on vasomotor changes in the inner ear Among these, tetraethylammonium salts are relative newcomers When they are used intravenously or intramuscularly a transient autonomic block at ganglion level is established and it can terminate an acute severe vasomotor labyrinthine attack

Modern therapy in vasomotor cochlearitis, vasomotor vestibulitis and vasomotor labyrinthitis, in either the acute or chronic form, aims at re-establishing the integrity of the inner ear circulation This may be accomplished through the neural blocking influence of tetraethylammonium chloride or the antihistamine drugs, or more directly through the vigorous vasodilating action of intravenous histamine or oral nicotinic acid There is no completely satisfactory drug available to us yet

Neural damage resulting from ischemia quickly becomes irreversible Treatment of the acute vasomotor crisis in the inner ear is emergent Otologists have an important education task before them in conveying that knowledge to the general medical group and to the public Neural damage from chronic vasomotor change is always irreversible Prevention is our only cure It is important to recognize the vasomotor unstable individual and demonstrate his early loss audiometrically Nicotinic acid is the best drug yet available for long term usage

Drug therapy has distinct limitations in a disorder in which emotional factors play a major etiologic rôle The patient with early and still tractable vasomotor irregularity in his labyrinth often needs correction in his attitude toward life Drug therapy serves best in the acute severe phase of vasomotor change Psychotherapy is frequently more important in maintaining stability once regained This is a fact which cannot be sufficiently emphasized The otologist, like any doctor of medicine, must fill a psychiatric rôle

Some systemic factors have an influence on the production of inner ear symptoms through autonomic mediation In the treatment of vasomotor change in the inner ear they should be given proper attention as contributors The endocrine system is controlled by the autonomic nervous system and the hypophysis Endocrine factors in women which influence vasomotor control during the menopause or at the time of the menstrual period accent vertigo and tinnitus in the autonomic unstable individual during those periods The low metabolic rate commonly found in both males and females with autonomic instability need not be a cause of their inner ear symptoms, but rather another result of faulty autonomic regulation The use of thyroid, therefore, should not be viewed as a complete method of treatment, but as an adjunct only The influence of fatigue and tobacco upon the vasomotor system makes adequate rest and abstinence from smoking one of the first rules of proper therapy

The patient with far advanced vasomotor labyrinthitis usually has permanent loss of useful hearing in the involved side with a vestibular mechanism still sufficiently viable to repeatedly disable him with attacks of vertigo Often his abnormal neurovascular habit is so deeply rooted that it responds poorly, if at all, to medical and psychiatric correction The number of advanced cases comprises an extremely small per cent of the total with vasomotor labyrinthine disease With early recognition and proper medical and psychiatric treatment, this small per cent will dwindle further Surgical destruction of the involved labyrinth is the only control measure one can at present offer the intractable case

Present-day labyrinthotomy destroys the useful residual hearing on the operated side For that reason, this surgery is reserved for disabled and uncontrollable cases with no useful hearing remaining on the involved side The possibility of future opposite side involvement in so general a disorder as vasomotor instability exists The sacrifice of useful hearing could be disastrous if, in the future, vasomotor cochlearitis developed in the opposite ear

The use of streptomycin by intramuscular injection to destroy the vestibular end-organ by selective neurotoxic action is receiving wide attention It is possible that its usage should be limited until its neurotoxicity is conclusively shown to exist for the vestibular end-organ alone An infrequent case of vasomotor vestibulitis may suffer severe and disabling vertigo, yet show no vasomotor change in the cochlea Labyrinthotomy is not applicable because useful hearing would be destroyed Streptomycin destruction of the vestibules would seem reasonable in such an instance

Summary The syndromes of the inner ear result from neurovascular and possibly neurosecretory change in the labyrinth

This change may be acute and severe as the result of sudden alteration in the vascular tonus of large segments of the neural mechanism of the inner ear and produce the picture of severe acute vasomotor labyrinthitis, vasomotor cochlearitis or vasomotor vestibulitis, or it may be chronic and insidious as the result of long continued and intermittent alterations in the vascular tonus of many small segments of the neural mechanism of the inner ear and result in chronic vasomotor labyrinthitis, vasomotor cochlearitis or vasomotor vestibulitis

These changes are mediated by autonomic mechanisms and differ not in kind but in degree

They occur most frequently in individuals with inherited autonomic instability

The majority of these individuals manifest evidences of autonomic dysfunction in other body systems

Extrinsic physical factors and intrinsic emotional stress are the commonest precipitators of autonomic dysfunction in the labyrinth

Proper medical and psychiatric treatment can relieve and control most of the vasomotor disorders of the inner ear

A small percentage require surgical destruction of labyrinthine components because of intractable autonomic dysfunction

BIBLIOGRAPHY

1 Eppinger, H and Hess, L 1909 Zur Pathologie des Vegetativen Nervensystems *Ztschr f Klin Med*, 66 345 351, 68 205 230

2 de No Lorente Neural Mechanism of Hearing The Laryngoscope, 47 376, 1937

3 Frazer, P F Vasomotor Control of the Ear *Jour Laryngol and Otol*, 51 579 586, 1936

4 Williams Henry L The Syndrome of Physical or Intrinsic Allergy of the Head *Proc Staff Meet Mayo Clin* 21 3

5 Guild, S R, Crowe, S J, and Polvogt, L M Pathology of High Tone Deafness *Bull Johns Hopkins Hosp*, Vol 54, 1934

6 Muller, Otfried Ueber den Saftestrom in Blut, Gewebsspalten und Lymphbahnen *Schw Med Wchnschr*, 70 365 369, Apr 27, 617 621, June 29 777 782, Aug 17, 901 906, Sept 21, 1940

7 Abell, R G, and Schenck, H P *Jour Immunol*, 34 195 213 Mar, 1938

8 Hallpike, C S, and Cairns, H Observations on the Pathology of Ménière's Syndrome *Jour Laryngol and Otol*, 53 625 634, 1938

9 Lindsay, J R Ménière's Disease, Histopathologic Observations *Arch Otolaryngol*, 39 313 318, 1944

444 Lowry Medical Arts Building

INTERNATIONAL CONGRESS OF OTOLARYNGOLOGY, LONDON, 1949

The British Association of Otolaryngologists is organizing the Fourth International Congress of Otolaryngology, to be held in London from July 17 to July 23, 1949 There will be further meetings, for those who wish to go, at Oxford, Cambridge and Edinburgh on July 25 and 26 It is hoped that a full academic program will be arranged, and also various social functions

The secretaries of the National Otolaryngological Societies have been circularized and asked to send a list of their members for individual notification Should any association not receive this letter, they should communicate with the General Secretary, F C W Capps, F R C S, 45, Lincoln's Inn Fields, London, W C 2

PRACTICAL ASPECTS OF LABYRINTHINE TESTS*

GORDON D HOOPLE, M D ,

Syracuse, N Y

We live in a dizzy world With each succeeding day, life becomes more complicated and living more complex Tensions mount, conflicts increase in number and degree The pace is too swift for some, and they fall by the wayside This is literally as well as figuratively true Some who drop out do so because they actually fall, victims of vertiginous attacks, whether fancied or real

This would appear to be the reason why there is an increasing number of patients who say they are dizzy Otolaryngologists do not see all who have this complaint They get to examine only a small part of them It is only when the internist or the general practitioner fails to effect a cure and the patient or the doctor is disturbed about the results obtained that members of the larger group are referred to the otolaryngologist A recent patient, who had been examined and treated by two neurologists, because she had not obtained relief from her dizziness, came to me and complained bitterly that neither of the two had examined her ears When examination revealed she had a labyrinthine disorder, she said, "I cannot understand this How could they treat me when they knew neither nature nor degree of my disorder ?"

Here in a nutshell is the problem There is more dizziness, and there is some ineffectual examination of those who have it It poses the question, "What can the otolaryngologist do about it?"

It is the purpose of this presentation to talk practically about labyrinthine examinations One can easily become lost

---

*Read at the Annual Meeting of the American Academy of Ophthalmology and Otolaryngology Chicago, Ill October 1948

Editor's Note This ms received in Laryngoscope Office and accepted for publication Oct 15 1948

in a technical discussion of the physiology of the labyrinth and its central connections When such experts as deKleyn, Versteegh, Dohlman, Hallpike, Kobrak, Speigel, McNally, Lindsay and others debate such subjects as nystagmus bereitschaft, utricular function, rhythmic phases of postrotatory nystagmus, postural reflexes, chronaxia and kindred problems, it is with difficulty that one follows their arguments When one considers, too, that an authority like Kobrak says, "The psychic component of nystagmus is important In testing for nystagmus, gross stimuli often produce considerable dizziness as well as nystagmus When marked dizziness appears, increased intensity of nystagmus (of the postrotatory type) almost inevitably follows," and McNally states, "It is known that the labyrinthine reaction will vary within limits from day to day even when the method of applying the stimulus to the labyrinth is fairly constant," one wonders if there is any worth in labyrinthine tests, and if they should be used at all This brings to mind the pleas of Lindsay and Walzl in their discussion of McNally's paper on Experimental Studies of Endolymphatic Flow, given before the Academy in 1947, and McNally's final summary, when each plead for simplicity of tests and urged that we should not try to deduce too much from too little When we attempt to deduce a great deal from small variations, we can become fogged in our thinking and reach fanciful diagnoses which may have no sound basis at all

These are reasons why a plea can be made for a practical approach to patients who have vertigo, and why in testing labyrinthine function practical tests should be employed A description will be given of one of these

Is it amiss to say that a good history is a practical labyrinthine test? I think not Technically, it is not a test, but practically, its employment will eliminate many who claim dizziness as an outstanding symptom Careful questioning will segregate most of the pyschogenics Pinning a patient down to an accurate description of his ailment will sometimes be most informative It is surprising how many patients will state they have dizziness, but in reality have only giddiness or light-headedness on arising quickly from a sitting position A few leading questions will classify others The order of the appearance of symptoms will differentiate Meniere's from Lermovez syndrome with consequent better prognosis in the latter If good questioning brings out the fact that the patient is truly a victim of vertiginous attacks, some additional questions as to past illnesses, possible allergies, the function of the patient's gastrointestinal, cardiovascular-renal, endocrine and nervous systems, etc , may bring one almost as near to the etiology as subsequent examination will This takes time The majority of otolaryngologists build their office schedules around 15-minute appointments No 15-minute appointment will adequately meet the demands of a truly dizzy patient Sometimes the history alone will take more than that

It is in the realm of physical examination that the otolaryngologist can score for himself and benefit the patient If one is committed to the investigation of patients with dizziness, there must be a more complete examination than merely scanning the ears, nose and throat and pouring a little cold water in the ears It takes but little additional time after a thorough examination of the ears, nose, nasopharynx and throat, to include a look at the pupils, a search of the eyegrounds, do a Romberg test, perform tests for spontaneous and positional nystagmus, to examine for gross neurological signs and order the necessary laboratory examinations In most instances the responses to these tests will be normal, but before any caloric tests are attempted they should be performed Let us stick to the practical One does not need to be an ophthalmologist to examine the eyegrounds, but the gross lesions depicting intracranial pathology or advanced arteriosclerosis should be discernible to one who has looked at more than an occasional one Nor do we need to be neurologists It takes but a few moments to test a few reflexes, ascertain if ataxia is present and learn something about the sensory pathways If these are grossly involved, we have diagnostic aids of worth If more detailed and intricate testing is necessary to bring out the evidence of neurologic involvement, it is not the responsibility of the otolaryngologist to make the final diagnosis This can and should be the neurologist's This keeps us in the realm of practicality

Certainly, in all these cases, it is our responsibility to do careful hearing tests Practically, they are of value With vertigo of central origin it is unusual, except in the instance of acoustic neuromas and possibly certain cerebellopontine angle tumors, to have involvement of hearing In vertigo of peripheral origin, if the hearing is good it is probable that the lesion in the labyrinth is not severe and the prognosis, therefore, is good Marked hearing loss and vertigo is a combination which should put every otolaryngologist on his toes

These matters attended to, there remains the functional examination of the labyrinth What tests shall we use? Can we continue to be practical?

We are all inclined to continue to use the methods in which we were trained Each of you is probably an advocate of the method you are presently using My experience has been to change from one method to another As I felt the shortcomings in one test, I found myself searching for a better It was not until I had the privilege of seeing the work of Hallpike and Cawthorne, and learned their method, that I felt I had a reasonably satisfactory test of labyrinthine function A description of this test and its suitability is the main purpose of this presentation

Before the description of the test is given, it might be well to mention why, for me, some of the better known tests of labyrinthine function have seemed to be somewhat unsatisfactory The turning chair tests both labyrinths at once, and while good information can be obtained from its use, there is always the disturbing necessity of differentiating the effect of one labyrinth upon the other The results of mass douching with cold water, continued till nystagmus appears, vary according to the density of the medium through which the thermal stimuli (hot or cold) must pass before the nerve endings in the labyrinth are excited The variation in time of the onset of nystagmus has never seemed to me to be truly diagnostic of labyrinthine function An estimate of the amplitude and rapidity of nystagmus of one side as compared to the other is certainly relative only unless there is a marked disparity Minimal douching, according to the Kobrak method where 5 cc of cooled water is used is controlled with difficulty With the use of such a small amount of water, the time of injection into one ear, contrasted to the other, presents a variable which probably has some bearing on the end-result The control of the temperature of the water is a hazard which is almost insurmountable As a test to determine whether or not a labyrinth has function, this is probably the most convenient method of all, but for testing one side against the other, it has definite limitations Douching with 1 cc of ice cold water has some of the limitations just mentioned, and, while it easy for the examiner, it is not so for the subject As a matter of fact, except for the Kobrak method, all of the above mentioned tests produce gross stimuli, which, it should be remembered, often produce marked dizziness and the latter gives rise to psychic reactions which may alter the degree and character of the nystagmic response In the hyperirritable, and there are a good many of these, there results a feeling of nausea, pallor and sweating which is most uncomfortable Occasionally there is vomiting All of the information obtainable with these tests is available in the Hallpike-Cawthorne method, with the elimination of these undesirable side effects

A description of the Hallpike-Cawthorne procedure follows In the prone position with the head elevated at an angle of 30 degrees, the patient is tested with water at 7° above and 7° below body temperature, *i e*, 44° and 30° Each ear is tested with both the hot and cold water The testing fluid is regulated to the desired temperature, stored in an irrigating can placed some two or three feet above the head of the patient, and, with as little waiting period as possible, fed to the ear through a rubber hose and appropriate nozzle The douching period in each instance is 40 seconds Prior to each douching, the water in the tubing is run off and discarded Marked variations in the temperature of the water in the tubing are posible Hence this precaution The duration time of the induced nystagmus is noted and charted in what the authors have chosen to call a calorigram During the period required for observation of the duration of the nystagmus the patient is instructed to look at a convenient mark on the ceiling directly overhead The authors and others who have tried this method feel the use of Bartel's glasses or Frenzel lenses is contraindicated This may prolong the reaction or diffuse the end-point Observations, intermittent in the early stages of the reaction in order to avoid fatigue, are made from an advantageous position and the end-point of nystagmus noted This is most easily accomplished by watching one of the small vessels of the sclera Some practice is needed to determine with a fair degree of accuracy the moment of the cessation of the nystagmus The recorded duration as noted on the calorigram extends from the application of the stimulus to the end of the nystagmic response This eliminates the necessity of watching for and noting the onset of nystagmus The charted duration on the calorigram is obviously not the duration of the nystagmus itself but the time interval from the start of the douching to the disappearance of the nystagmus In other words, it is the nystagmus response to a standard stimulus While attention is principally devoted to the duration time, the authors note that the degree of intensity of the nystagmus and the patient's subjective reactions (dizziness) should be recorded A small difference in duration time between the two ears is of much more significance if it is associated with an obvious difference in intensity of nystagmus and dizziness

The authors of this method note the results of tests in 50 individuals between the ages of 20 and 55 with normal hearing and without symptomatic or other evidence of vestibular disorder In 80 per cent of these, the duration of the cold reactions varied between 1 minute, 30 seconds and 2 minutes, 10 seconds In 80 per cent the cold reactions were in excess of the hot, usually by 5 to 15 seconds In 10 per cent the cold and hot reactions were approximately equal, and in 10 per cent the hot reactions exceeded the cold with a maximum difference of 15 seconds In 80 per cent the cold reactions of the two ears showed a difference of 5 seconds or less In 10 per cent this difference was 10 seconds, and 20 to 25 seconds in the remaining 10 per cent Differences of a similar order were observed in the hot reactions

Fitzgerald, Hallpike and Cawthorne state that, "The test was evolved in a calculated endeavor to push to its limits the resolving power of the caloric tests," but they follow this by saying, "—this technique had greatly facilitated the recognition of abnormal reactions in patients with collateral evidence of vestibular disease" The former statement implies they are attempting to squeeze the last drop of blood from the life of the caloric test and that minimal differences between the two ears or between the hot and cold caloric stimulations in one ear are of prime importance This is not true They become practical when they say, in substance, that abnormalities of the test have more significance when these abnormalities are supported by collateral evidence of vestibular disease

Criticisms of this test have appeared in the literature Clarke, Gloria and Fowler, and McNally have pointed out that the 44° water reaches the ear at a temperature considerably lower than that figure and may be as low as 42° They also note the temperature of the 30° water may not be that figure when it is delivered to the ear It is argued from this that the test does not follow a standard and that the response to the hot stimulus cannot be compared to the cold as they are not equal stimuli (Gloria and Fowler have used thermos jugs to obviate the temperature changes) The point is academic No one of these authors has noted the temperature of their patients at the time of testing A variant here may be as significant as the changes noted above The method should be considered from its practical aspects It should be noted that the stimulus is as standard as any that has been devised and, most important, if all four douchings are carried out at one sitting the method tests the reactions of one ear against the other under these standards One is not so much interested in the variation of nystagmus duration between the hot and cold stimulus in one ear as one is to learn the difference there may be between the two ears as they react to one or the other of the stimuli

In addition to the fact that the stimuli to each ear are quite comparable, this method has advantages of worth With the small temperature differences which the test employs, there is almost never an undesirable reaction The douching is reasonably comfortable and the patient harbors no unpleasant memories of the test Rarely does nausea come into the picture, nor the pallor and sweating of grosser tests The method provides a check of reasonable worth It is true that the duration responses to the hot and cold water are not usually exactly equal, but each checks the other, particularly when the four reactions are compared (Incidentally, the reactions are repeatable The duration response to the same stimulus in the same ear if retested will have no appreciable variation)

Little will be said here of directional preponderance, a full discussion of which would change this presentation from the practical to the theoretical In the great majority of subjects tested, the duration of nystagmus will be relatively equal for all four douchings, or the two douchings of one ear will be out of proportion to the two in the other In directional preponderance the douchings which produce nystagmus in one direction (either to the right or left) are of longer duration than the douchings which produce nystagmus in the opposite direction This finding has some clinical significance and is found in tumors of the temporal lobe, the direction of the preponderance being to the side of the lesion It is also found in some instances of vestibular disease The mechanism of directional preponderance is still under debate. Practically, it exists and often is confirmatory to other evidences of vestibular abnormality

Place the findings obtained by this test alongside the results of the physical examination and the history, study the combination and the diagnostic evidence accumulated will be gratifying Normal findings will sometimes appear when altered reactions are expected

A very occasional bizarre reaction will occur which will be difficult to interpret In the main, however, it is surprising how frequently one feels the test has been of material help in forming a diagnosis

One illustration will perhaps suffice to show how the Hallpike-Cawthorne test is more informative than some other tests which are commonly used Recently, an otolaryngologist referred a patient to our office This patient had primarily a hearing problem, but there was in the history good evidence of attacks of dizziness The referring otolaryngologist in an accompanying letter stated he had used 5 cc of iced water in testing the patient's labyrinthine function His conclusion was, that in addition to a hearing loss, this patient had evidence of slight hypoactivity of the right labyrinth Without any intervening attacks of dizziness between our examination and the first, a Hallpike-Cawthorne test, showed no response to either the hot or cold stimulus in the right (involved) ear Immediately following the test, cold tap water was douched into the right ear for one minute Only then did a nystagmic response appear The right labyrinth was not dead, but it certainly had more than a slight hypoactivity When there is no response to the douching by hot or cold water according to the Hallpike-Cawthorne method, there is signal pathology in the vestibular apparatus

Here, then, is a method of caloric testing which has a reasonable standardization of stimulus with an attribute (duration of nystagmus) which can be measured and which is often informative In conjunction with allied examinations and a good history, its findings seem more conclusive than those elicited by other caloric tests

Bilateral calorization and galvanic stimuli are adjuncts which may be used to obtain additional information to the above, but to the average otolaryngologist these are tests which belong to the finer realm of neuro-otology

There is a great hue and cry heard these days about the diminishing scope of otolaryngology Chemotherapy has robbed it of some of its most spectacular surgery Surgeons in bordering fields are invading the precincts of the specialty

The pathologies of the vestibular branch of the VIIIth nerve, including those of the end-organ and its central pathways, cover a field into which few have ventured, it has been left to the otologist There is no reason why we whose medical interests include the diseases of the ear should not be as well equipped to examine the VIIIth cranial nerve as the ophthalmologist is the IInd There is an increasing number of patients who complain of dizziness, and they are clamoring for better diagnosis and treatment Clear thinking is required to separate the imagined from the real Careful histories and examinations are needed to separate actual disease of the end-organ from conditions which alter the function of the end-organ The same can be said for the differential diagnosis of lesions of the end-organ and central pathologies Some suggestions of a practical approach to these problems and a practical method of examination have been presented In this area there is an opportunity for better service than has been rendered in the past

713 East Genesee Street

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETS AT ST LOUIS, SEPT 28, 29, 30, 1949

The Fourteenth Annual Meeting of the Mississippi Valley Medical Society will be held at the Jefferson Hotel, St Louis, Mo, Sept 28, 29, 30, 1949, under the presidency of Dr Alphonse McMahon, of St Louis University At the recent current meetings of the Society and board of directors, the following officers were elected Dr Nathaniel G Alcock, Iowa City, Iowa, President-elect, Dr Wendell G Scott, St Louis, Mo, First Vice-President, Dr Charles F Harmon, Springfield, Ill, Second Vice-President, Dr John I Marker, Davenport, Iowa, Third Vice-President, Dr Harold Swanberg, Quincy, Ill, Secretary-Treasurer, Dr Ralph McReynolds, Quincy, Ill, Accounting Officer

LABYRINTHINE SURGERY FOR MENIERE'S DISEASE[*][†]

J R LINDSAY, M D,
Chicago, Ill

Meniere's disease is characterized by recurring attacks of vertigo, along with auditory symptoms of a distinctive type The inner ear pathology which causes these disturbances is now known to be a hydrops of the labyrinth The type of hydrops found in this condition differs essentially from that commonly found in inflammatory inner ear disease, but the etiology is indefinite and therefore it is called "idiopathic hydrops" The most favored theory as to the etiology seems to be that a disturbance in the secretary apparatus leads to oversection of endolymph

The most predominating symptom of this disease and the one which causes greatest disability is the recurring vertigo The most consistent symptom and the one which is necessary for diagnosis is the loss of hearing which begins as a low tone inner ear impairment Other auditory symptoms which vary greatly but may be so severe as to be of great subjective concern are low-pitched tinnitus, a sense of blockage in the ear and a disagreeable disturbance of the quality of the tone, usually a diplacusis The auditory symptoms fluctuate in severity and the hearing threshold varies widely from time to time, but the loss tends to become progressively greater

The diagnosis is usually made when both auditory symptoms and vertigo are present In the infrequent case, however, it is possible to make the diagnosis on the basis of the characteristic nature of the auditory symptoms without the presence of vertigo

---

[*] Presented before the American Academy of Ophthalmology and Otolaryngology Chicago, Ill October, 1948

[†] From the Division of Otolaryngology, the University of Chicago

Editor's Note This ms received in Laryngoscope Office and accepted for publication October 15 1948

The use of surgery in the treatment of the disease has been directed primarily at the prevention of vertigo Although this has been consistently accomplished by a number of methods, no treatment can be considered wholly satisfactory unless the effect on the auditory apparatus is also favorable

In view of the nature of the pathologic lesion in the ear, surgery cannot be expected to cause any great improvement in hearing Also, since the disagreeable tinnitus and diplacusis probably take origin from the same cause as the hearing loss, it is unlikely that surgery can relieve them without destroying auditory function

At the present time surgery is, therefore used as a last resort in those cases which have not been sufficiently helped by medical therapy The percentage in such cases varies according to different reports but would appear to be somewhere between 10 and 20

Menière's disease is a unilateral process in approximately 90 per cent When bilateral the time of onset in the second ear varies It may be soon or not until four or five years after the first The hearing loss may be about equal or may continue to be greater in the originally involved ear

In the bilateral case, therefore, a surgical procedure that may destroy hearing is unsuitable, except in the cases where the symptoms can be definitely ascribed to the ear with much the poorer function

In the unilateral case the preservation of the remaining hearing is usually of little service to the patient except as a reserve that might be used in case of injury to or similar involvement of the other ear This latter possibility, however, is of sufficient importance to warrant a search for a surgical procedure which might permit selective destruction of the vestibular function by the relatively safe intralabyrinthine route

Intracranial division of the vestibular fibres of the VIIIth nerve, first performed by McKenzie,[1] and strongly recom-

mended by Dandy,[2] preserves auditory function The method has given excellent results but falls short of an ideal treatment in that the process in the inner ear is probably not impeded or influenced, also that the intracranial approach may carry some operative risk if not expertly carried out

LABYRINTHINE SURGERY

Surgical procedures on the labyrinth have attracted much attention because of the simplicity with which they can be carried out and the absence of operative risk

PORTMANN'S OPERATION[3] DRAINAGE OF THE SACCUS ENDOLYMPHATICUS

Portmann's operation consisting of drainage of the saccus endolymphaticus was conceived before the pathological process was known The discovery by Hallpike and Cairns[4] of a hydrops of the labyrinth in Meniere's disease appeared to strengthen Portmann's thesis that drainage of the saccus was a logical procedure Portmann reported good results, but the experience of others in smaller numbers of cases has been less favorable, and the method is not in general use

EXPERIMENTS ON THE SACCUS AND DUCTUS ENDOLYMPHATICUS

In order to demonstrate the effect of simple drainage of the saccus and ductus endolymphaticus and also to obtain experimental evidence regarding the function of these structures in the maintenance of the volume of endolymph, a series of experiments was done in the monkey These consisted of both simple drainage of the saccus and various degrees of destruction of the ductus endolymphaticus[5] In three ears the saccus and medial convoluted part of the ductus, described as Sinus II by Anson and Wilson,[6] were completely destroyed After a period of between three and one half and four months the defect was completely filled in by new bone and marrow, but the remainder of the endolymphatic system and the sensory organs showed no histological variation from the normal

The conclusion seemed warranted from these experiments

that the maintenance of a normal volume of endolymph is not dependent upon a functioning ductus endolymphaticus or even upon its existence, also, that the occurrence of a hydrops or Menière's disease could not be attributed to interference with normal absorption of endolymph from its dilated and convoluted middle portion

It was also demonstrated clearly that drainage and partial destruction of the saccus was followed by sealing off and healing of the defect without any demonstrable effect on the labyrinth beyond

Any effect of Portmann's operation on Ménière's disease would, therefore, be of only relatively brief duration

ALCOHOL INJECTION

The injection of alcohol into the labyrinth has been used chiefly in England Mollison[7] opened the external semicircular canal and injected three minims of absolute alcohol after first withdrawing a similar amount of perilymph Reports by him and also by Wright[8] and McDowall,[9] who used the same method, have been favorable as regards prevention of vertigo, although not completely successful Deafness followed in all cases Tinnitus has, however, remained undiminished in as many as one-third of the latter's cases

Ablation of a Membranous Semicircular Canal Removal of a part of the membranous horizontal semicircular canal has sometimes occurred accidentally during the fenestration procedure for otosclerosis, usually during a revision Personal experience in two such cases was that a further loss of hearing occurred postoperatively, and the fistula response was negative This was followed in several weeks by a return of hearing to the preoperative level for speech frequencies The fistula response never became positive

Although reports are lacking in the literature, personal communications indicate that the experience of others has been similar in at least some of their cases There is, therefore, evidence that removal of part of the membranous canal

mended by Dandy,[2] preserves auditory function The method has given excellent results but falls short of an ideal treatment in that the process in the inner ear is probably not impeded or influenced, also that the intracranial approach may carry some operative risk if not expertly carried out

LABYRINTHINE SURGERY

Surgical procedures on the labyrinth have attracted much *attention because of the simplicity with which they can be* carried out and the absence of operative risk

PORTMANN'S OPERATION [3] DRAINAGE OF THE SACCUS ENDOLYMPHATICUS

Portmann's operation consisting of drainage of the saccus endolymphaticus was conceived before the pathological process was known The discovery by Hallpike and Cairns[4] of a hydrops of the labyrinth in Meniere's disease appeared to strengthen Portmann's thesis that drainage of the saccus was a logical procedure Portmann reported good results, but the experience of others in smaller numbers of cases has been less favorable, and the method is not in general use

EXPERIMENTS ON THE SACCUS AND DUCTUS ENDOLYMPHATICUS

In order to demonstrate the effect of simple drainage of the saccus and ductus endolymphaticus and also to obtain experimental evidence regarding the function of these structures in the maintenance of the volume of endolymph, a series of experiments was done in the monkey These consisted of both simple drainage of the saccus and various degrees of destruction of the ductus endolymphaticus [5] In three ears the saccus and medial convoluted part of the ductus, described as Sinus II by Anson and Wilson,[6] were completely destroyed After a period of between three and one half and four months the defect was completely filled in by new bone and marrow, but the remainder of the endolymphatic system and the sensory organs showed no histological variation from the normal

The conclusion seemed warranted from these experiments

that the maintenance of a normal volume of endolymph is not dependent upon a functioning ductus endolymphaticus or even upon its existence, also, that the occurrence of a hydrops or Ménière's disease could not be attributed to interference with normal absorption of endolymph from its dilated and convoluted middle portion.

It was also demonstrated clearly that drainage and partial destruction of the saccus was followed by sealing off and healing of the defect without any demonstrable effect on the labyrinth beyond.

Any effect of Portmann's operation on Ménière's disease would, therefore, be of only relatively brief duration.

ALCOHOL INJECTION

The injection of alcohol into the labyrinth has been used chiefly in England. Mollison[7] opened the external semicircular canal and injected three minims of absolute alcohol after first withdrawing a similar amount of perilymph. Reports by him and also by Wright[8] and McDowall,[9] who used the same method, have been favorable as regards prevention of vertigo, although not completely successful. Deafness followed in all cases. Tinnitus has, however, remained undiminished in as many as one-third of the latter's cases.

Ablation of a Membranous Semicircular Canal. Removal of a part of the membranous horizontal semicircular canal has sometimes occurred accidentally during the fenestration procedure for otosclerosis, usually during a revision. Personal experience in two such cases was that a further loss of hearing occurred postoperatively, and the fistula response was negative. This was followed in several weeks by a return of hearing to the preoperative level for speech frequencies. The fistula response never became positive.

Although reports are lacking in the literature, personal communications indicate that the experience of others has been similar in at least some of their cases. There is, therefore, evidence that removal of part of the membranous canal

mended by Dandy,[2] preserves auditory function The method has given excellent results but falls short of an ideal treatment in that the process in the inner ear is probably not impeded or influenced, also that the intracranial approach may carry some operative risk if not expertly carried out

LABYRINTHINE SURGERY

Surgical procedures on the labyrinth have attracted much attention because of the simplicity with which they can be carried out and the absence of operative risk

PORTMANN'S OPERATION[3] DRAINAGE OF THE SACCUS ENDOLYMPHATICUS

Portmann's operation consisting of drainage of the saccus endolymphaticus was conceived before the pathological process was known The discovery by Hallpike and Cairns[4] of a hydrops of the labyrinth in Ménière's disease appeared to strengthen Portmann's thesis that drainage of the saccus was a logical procedure Portmann reported good results, but the experience of others in smaller numbers of cases has been less favorable, and the method is not in general use

EXPERIMENTS ON THE SACCUS AND DUCTUS ENDOLYMPHATICUS

In order to demonstrate the effect of simple drainage of the saccus and ductus endolymphaticus and also to obtain experimental evidence regarding the function of these structures in the maintenance of the volume of endolymph, a series of experiments was done in the monkey These consisted of both simple drainage of the saccus and various degrees of destruction of the ductus endolymphaticus[5] In three ears the saccus and medial convoluted part of the ductus, described as Sinus II by Anson and Wilson,[6] were completely destroyed After a period of between three and one half and four months the defect was completely filled in by new bone and marrow, but the remainder of the endolymphatic system and the sensory organs showed no histological variation from the normal

The conclusion seemed warranted from these experiments

after it has impinged on the wall of the vestibule before applying the current

The author's experience with the coagulation procedure in Meniere's disease has been limited to eight cases In most cases the coagulation was limited to the membranous horizontal canal and its ampulla but was sufficiently strong and repeated so as to destroy these structures In some the coagulation undoubtedly involved the utricle also In one case the coagulation was applied to two canals at approximately a maximum distance from the ampullae In all cases the hearing loss was increased to the point where no definite hearing could be demonstrated although tested over periods of years thereafter

Prevention of attacks of vertigo was accomplished in five cases, one could not be followed up, and two cases developed occasional mild vertigo, which was apparently caused by the opposite ear

In some cases there was intermittent low-pitched tinnitus after several months had elapsed and along with it a sense of blockage in the ear, which, although not so severe as before operation, was sufficient to cause some apprehension that it might be followed by an attack of vertigo

Discussion When the results of Day's cases are combined with those of others who have used the coagulation procedure and the experience with coagulation limited to the canals and ampullae only, it would appear that preservation of the hearing can be anticipated only occasionally or, at most, in a small minority of such cases

The coagulation procedure has been successful as a means of preventing attacks of vertigo and subjectively has been a satisfactory treatment In most cases the further loss of hearing causes no disability but it is of sufficient importance to limit this form of surgical therapy to a relatively small percentage of cases An intralabyrinthine surgical procedure which would consistently preserve hearing while preventing vertigo would undoubtedly become a treatment of choice in a much larger group without its ampullary end destroys function of that canal but does not destroy hearing in at least many of the cases

In the fenestrated monkey's ear destruction and obliteration of one canal produces no histologic change in the vestibule or in the auditory apparatus

Cawthorne[10] has treated a large number of cases of Meniere's disease by removal of the ampullary end of the membranous horizontal canal apparently along with its ampulla

He has reported consistently good results in preventing attacks of vertigo, but all cases were reported to be deaf in the operated ear

It would seem that these results in Meniere's disease do not correspond to the experience with otosclerotics Also, the histologic findings in the monkey's ear suggest that if the injury is limited to the canal and its ampulla, the auditory apparatus escapes injury

Coagulation of the Labyrinth Coagulation of the horizontal membranous canal, ampulla and the vestibule through a small fistula near the ampulla in cases of Meniere's disease was first reported by Day [11] His results in preventing further attacks of vertigo have been uniformly good He reported relief of tinnitus in nearly all cases and a preservation of useful hearing in approximately 10 per cent He has had no complications from the operation McNally[12] has reported one case, however, in which there was a facial palsy for several months following coagulation, thereby indicating that the facial nerve is not completely free from the danger of injury

The experience of others, for example, Sullivan as reported by Ireland,[13] who have used the coagulation procedure in the vestibule, has been that profound deafness followed without exception

The explanation of Day's more favorable experience suggests the possibility of some variation in technique, such as his stated practice of withdrawing the coagulating tip slightly after it has impinged on the wall of the vestibule before applying the current

The author's experience with the coagulation procedure in Ménière's disease has been limited to eight cases In most cases the coagulation was limited to the membranous horizontal canal and its ampulla but was sufficiently strong and repeated so as to destroy these structures In some the coagulation undoubtedly involved the utricle also In one case the coagulation was applied to two canals at approximately a maximum distance from the ampullae In all cases the hearing loss was increased to the point where no definite hearing could be demonstrated although tested over periods of years thereafter

Prevention of attacks of vertigo was accomplished in five cases, one could not be followed up, and two cases developed occasional mild vertigo, which was apparently caused by the opposite ear

In some cases there was intermittent low-pitched tinnitus after several months had elapsed and along with it a sense of blockage in the ear, which, although not so severe as before operation, was sufficient to cause some apprehension that it might be followed by an attack of vertigo

Discussion When the results of Day's cases are combined with those of others who have used the coagulation procedure and the experience with coagulation limited to the canals and ampullae only, it would appear that preservation of the hearing can be anticipated only occasionally or, at most, in a small minority of such cases

The coagulation procedure has been successful as a means of preventing attacks of vertigo and subjectively has been a satisfactory treatment In most cases the further loss of hearing causes no disability but it is of sufficient importance to limit this form of surgical therapy to a relatively small percentage of cases An intralabyrinthine surgical procedure which would consistently preserve hearing while preventing vertigo would undoubtedly become a treatment of choice in a much larger group

ANIMAL EXPERIMENTS ON COAGULATION AND INTRALABYRINTHINE NERVE INJURIES

A series of experiments on the rabbit's ear done in our laboratory by Dr. Bruce Proctor before penicillin was available, but not reported, showed that instrumentation within the vestibule in the attempt to rupture or injure the utricle resulted in extensive fibrosis in the perilymphatic spaces and varying degrees of hydrops and degeneration of sensory organs. These results, along with early experiences with operations on the human, led to further experiments to determine the extent to which the vestibular apparatus might be injured by coagulation or instrumentation without causing histologic changes in the auditory sense organ. More recently the effects of the use of the coagulating current within the vestibule have been demonstrated by Schall and Rambo[15]. These have confirmed the *improbability of preserving hearing in more than* a minority of cases when treated by coagulation within the vestibule.

The following experiments were done on the monkey's ear during the past several years to determine their effect on the histologic appearance of the auditory sense organ. Coagulation of the ampulla of the horizontal canal. Coagulation of all canals at maximum distance from the vestibule. Injury to the nerves to the horizontal canal ampulla and to the utricle, and in one case detachment of the otolithic membrane of the utricle. Introduction of the coagulating tip and the use of current which was not strong enough to cause bubbling or visible changes, although sufficiently strong to produce a facial nerve stimulus.

All ears were prepared and examined histologically. In practically all cases histologic evidence of the injury to the vestibular apparatus was demonstrable. It was found that in no case had the injury resulted in any extensive change or fibrosis in the perilymphatic space of the vestibule.

In one animal sacrificed within 24 hours of coagulation there were collections of red blood cells in the perilymphatic spaces and an altered staining reaction of the perilymph, but in all others sacrificed after several days or weeks there was no evidence of hemorrhage

None of the procedures involving limited instrumental injury to the ampullary nerve and utricle or coagulation which was limited to the canals and ampullae resulted in any histologic change in the auditory apparatus In no case was there more than a minimal amount of fibrous tissue in the perilymphatic cistern

In the ear which was fixed within 24 hours after the coagulation there was some suggestion of a chemical change in the perilymph, as indicated by the altered staining reaction

The histologic findings in these ears failed to provide an explanation for the profound loss of hearing which occurred in humans in which the coagulation procedure had been limited to canals or their ampullae only

SIMPLE FENESTRATION, DECOMPRESSION OF PERILYMPH, INTRALABYRINTHINE NERVE INJURIES

In the search for a method to prevent vertigo while preserving cochlear function, several procedures were carried out on humans with intractable Ménière's disease

Case 1 G R male age 40 advanced unilateral Ménière s disease unrelieved by medical therapy Serious disability from vertigo and average hearing loss of over 60 db in speech frequencies This patient had a previously healed radical mastoid cavity On July 15 1940 a fenestra was made near the horizontal canal ampulla and a barbed dental broach passed through the ampullary nerve into the vestibule in an anterior direction until it impinged on the opposite wall and then was withdrawn This was repeated No bleeding or visible injury to the membranous canal or its ampulla was observed despite the use of the barbed instrument. The fenestra was covered with a skin flap The hearing in the ear was further impaired to a state of profound deafness Vertigo was relieved except for mild recurrences on infrequent occasions but no longer caused any disability

Although the ear was profoundly deaf tinnitus and a sense of blockage of mild degree have been intermittenly present. The fistula response has remained active and the fenestra is visible through the thin covering skin. The response to cold caloric stimulation with ice water was absent two months following operation but has become active to an approximately normal degree since that time There has been no Tullio phenomenon

Case 2 E B, female age 32 Unilateral Ménière s disease for three years unrelieved by medical therapy Fluctuating hearing threshold averaging about 40 db loss for speech frequencies On April 3 1945, a simple mastoidectomy was done and a fenestra made in the horizontal canal near which only a simple festra was created, suggests that the existence of a third window into the labyrinth in the presence of an intact conducting mechanism results in a definite threshold loss

Whether such a hearing loss in the first three cases would have been avoided by causing the fistulas to close, thereby limiting the procedure to the intralabyrinthine injury, has not yet been determined

SUMMARY

1 The prevention of attacks of vertigo, along with destruction of auditory function, has been formerly accomplished by labyrinthectomy operations, all of which involve extensive destruction of structures in the vestibule Efforts to prevent vertigo by intralabyrinthine surgery without causing destruction of hearing have so far met with limited success The following procedures have been done on humans

a Portmann's operation on the saccus endolymphaticus This operation has preserved the hearing but has failed to give sufficiently good results in prevention of vertigo

Experiments on the monkey have shown that drainage or destruction of the saccus, as well as nearly all of the ductus endolymphaticus, is followed by prompt healing and, therefore, could have only a limited effect on a hydrops of the labyrinth

b Ablation of the ampullary end of the horizontal semicircular canal has been reported by Cawthorne to prevent attacks of vertigo consistently, but also to cause deafness

Accidental removal of part of the membranous canal at the fenestration operation or its revision causes temporary deafness, but hearing frequently returns to the previous level

Obliteration of the horizontal canal for several millimeters distal to the ampulla in the monkey causes no histologic change in the auditory apparatus in most instances

c Coagulation of the ampullated end of the horizontal canal, with the tip of the instrument extended into the vestibule (Day's procedure) has prevented vertigo attacks consistently Preservation of hearing occurred in about 10 per cent of Day's cases but not in those reported by others

d Coagulation limited to one or more canals without entering the vestibule has prevented attacks of vertigo but caused profound deafness It did not always abolish intermittent tinnitus and sense of blockage in the ear

In the monkey, it caused no histologic evidence of injury to the auditory apparatus

e Decompression of perilymph is of no value in treatment of Ménière's disease

f A simple fistula in the horizontal canal, if made after simple mastoidectomy and left uncovered, the mastoid wound being closed, remains as an open fenestra beneath the mucosa which later lines the mastoid antrum Such a fenestra in the presence of Ménière's disease is undesirable because of the further loss of hearing which occurs, the disturbing Tullio reaction and the possible tendency to facilitate infection of the labyrinth in case of a middle ear infection

Closure of a fistula can be assured by keeping it a minimum size, leaving bone dust in it, and by destroying the membranous canal

g The histologic evidence obtained from monkey experiments as well as the experience of Day in his use of coagulation on the human lend encouragement to the search for a means of interrupting vestibular function without injuring the auditory apparatus Further investigations are being carried out in which sound conditioned animals are utilized as well as histologic controls

BIBLIOGRAPHY

1 Mackenzie, Kenneth G Intracranial Division of the Vestibular Portion of the Auditory Nerve for Ménière s Disease *Canad Med Assn Jour.*, 34 369-381 Apr, 1936, *Trans Acad Med of Toronto*, 1932

2 Dandy W E The Surgical Treatment of Ménière's Disease *Surg, Gynec and Obst.*, 72 421-425 Feb, 1941

the ampulla. An unbarbed dental broach was passed anteriorly through the nerve to the ampulla until it impinged on the wall of the vestibule in the attempt to damage the nerve to the utricle as well. This was repeated. There was no visible injury to the membranous canal or ampulla and no hemorrhage.

The middle ear conducting apparatus was avoided entirely. No covering was applied to the fenestra. A few sulfathiazole crystals were sprinkled in the cavity and the wound closed. Penicillin was given for several days thereafter.

The wound healed by first intention. Afterwards, deafness was found to be profound in the operated ear. The fistula response remained strongly active, on pressure, strenuous nose blowing and sneezing. A Tullio[14] reaction was present on exposure to loud sounds or noises and caused great annoyance. Although the ear was deaf, an intermittent sense of blockage and tinnitus presisted. While the fistula response was strongly active, the cold caloric response was found to be diminished with the head at 60 degrees backwards. Attacks of vertigo were infrequent but of sufficient severity that a secondary operation was done on June 12, 1946, over 14 months after the first operation. At this time the mastoid cavity was found to consist of one large air cell, the lining mucoperiosteum of which formed the covering of the fenestra, which was widely open.

The membranous canal and ampulla were then destroyed by coagulation, the coagulating tip extending slightly into the vestibule.

After operation, vertigo was moderate, receding gradually over several weeks. No further attacks of vertigo had occurred when last observed several months after operation.

Case 3. E. M. H., male, age 55. Unilateral Ménière's disease for two years which had resisted medical therapy and was a serious hazard for his occupation of railroad switchman. There was an average hearing threshold loss of about 35 db. for speech frequencies.

On May 12, 1945, a simple mastoidectomy was done and a fenestra made as in Case 2, with a similar attempt to injure the nerves to the horizontal canal ampulla and utricle. The wound was closed in a similar way, with no covering being placed over the fistula. Sulfathiazole crystals were dusted into the wound and penicillin therapy given parenterally postoperatively. Recovery was rapid. The ear was profoundly deaf after operation and has remained so until the present time. There is still slight hissing type of tinnitus in the ear, but the severe noises have been relieved. An active Tullio[14] phenomenon has been present since operation and is activated by such sudden sounds as a sudden escape of steam from a locomotive, the grinding of car wheels and ringing of the engine's bell close by.

The fistula response remains strongly positive on pressure over the mastoid scar. There have been occasional mild attacks of dizziness, but patient considers himself sufficiently relieved to remove the hazard and he wishes no further treatment.

Case 4. J. B., male, age 51. Ménière's disease in the right ear of about 20 years duration with threshold hearing loss of over 60 db. for speech frequencies. He also had a threshold hearing loss in the left ear which was less marked, but which showed wide fluctuations for speech frequencies. Although patient referred most of his complaints to the more impaired ear, a diagnosis of early Ménière's disease in the better ear seemed indicated as well.

For the purpose of obtaining further information, a two-stage operation on the more impaired ear was decided upon. On Oct. 11, 1946, a simple mastoidectomy was done as in Cases 2 and 3 There was no mastoid pneumatization, but a moderately large antrum was found A simple fenestra was made without injuring the membraneous labyrinth and without attempting any interference within the bony labyrinth No covering was placed over the fenestra The wound was closed after dusting in a few sulfathiazole crystals and penicillin was given for several days

Recovery from the operation was rapid The ear which had about 60 db threshold loss for speech frequencies before operation was totally deaf to a loud shout and to the audiometer thereafter when the opposite ear was masked

An active fistula response persisted as well as annoying vertigo whenever he was close to loud noises (Tullio phenomenon) The tinnitus was not relieved and attacks of vertigo persisted as well as that which occurred because of the open fistula Seven months after the first operation the wound was reopened for inspection of the fenestra and coagulation of the membranous labyrinth The antrum was again pneumatized and the fenestra found to be widely open and covered by the semitransparent mucoperiosteum The canal and ampulla were then coagulated the coagulating tip being extended into the vestibule but not to the opposite wall

Following coagulation there has been relief from the Tullio reaction and from the vertigo related to the open fenestra but there have also been occasional spontaneous attacks of vertigo which may have originated from the other ear

Tinnitus has also been present but not well localized to either ear

DISCUSSION

The experience with these cases has permitted several observations of significance

1 Decompression of perilymph is of no value as a relief to Ménière's disease, or hydrops of the labyrinth

2 A fistula made in a bony semicircular canal through a simple mastoid approach and left uncovered will probably remain a permanently open fenestra[14] This is undesirable because of the associated fistula symptoms and Tullio phenomenon Also, a fenestra covered only by mucosa might offer less resistance to infection in case of subsequent middle ear suppuration

Closure of a fistula can be assured at operation by making a very small opening and leaving bone chips in it, and probably also by destruction or removal of the membranous labyrinth

3 The depression of the hearing threshold to a state of profound deafness in all four of these ears, including that in which only a simple festra was created, suggests that the existence of a third window into the labyrinth in the presence of an intact conducting mechanism results in a definite threshold loss

Whether such a hearing loss in the first three cases would have been avoided by causing the fistulas to close, thereby limiting the procedure to the intralabyrinthine injury, has not yet been determined

SUMMARY

1 The prevention of attacks of vertigo, along with destruction of auditory function, has been formerly accomplished by labyrinthectomy operations, all of which involve extensive destruction of structures in the vestibule Efforts to prevent vertigo by intralabyrinthine surgery without causing destruction of hearing have so far met with limited success The following procedures have been done on humans

a Portmann's operation on the saccus endolymphaticus This operation has preserved the hearing but has failed to give sufficiently good results in prevention of vertigo

Experiments on the monkey have shown that drainage or destruction of the saccus, as well as nearly all of the ductus endolymphaticus, is followed by prompt healing and, therefore, could have only a limited effect on a hydrops of the labyrinth

b Ablation of the ampullary end of the horizontal semicircular canal has been reported by Cawthorne to prevent attacks of vertigo consistently, but also to cause deafness

Accidental removal of part of the membranous canal at the fenestration operation or its revision causes temporary deafness, but hearing frequently returns to the previous level

Obliteration of the horizontal canal for several millimeters distal to the ampulla in the monkey causes no histologic change in the auditory apparatus in most instances

c Coagulation of the ampullated end of the horizontal canal, with the tip of the instrument extended into the vestibule (Day's procedure) has prevented vertigo attacks consistently Preservation of hearing occurred in about 10 per cent of Day's cases but not in those reported by others

d Coagulation limited to one or more canals without entering the vestibule has prevented attacks of vertigo but caused profound deafness It did not always abolish intermittent tinnitus and sense of blockage in the ear

In the monkey, it caused no histologic evidence of injury to the auditory apparatus

e Decompression of perilymph is of no value in treatment of Ménière's disease

f A simple fistula in the horizontal canal, if made after simple mastoidectomy and left uncovered, the mastoid wound being closed, remains as an open fenestra beneath the mucosa which later lines the mastoid antrum Such a fenestra in the presence of Ménière's disease is undesirable because of the further loss of hearing which occurs, the disturbing Tullio reaction and the possible tendency to facilitate infection of the labyrinth in case of a middle ear infection

Closure of a fistula can be assured by keeping it a minimum size, leaving bone dust in it, and by destroying the membranous canal

g The histologic evidence obtained from monkey experiments as well as the experience of Day in his use of coagulation on the human lend encouragement to the search for a means of interrupting vestibular function without injuring the auditory apparatus Further investigations are being carried out in which sound conditioned animals are utilized as well as histologic controls

BIBLIOGRAPHY

1 MACKENZIE, KENNETH G Intracranial Division of the Vestibular Portion of the Auditory Nerve for Ménière's Disease *Canad Med Assn Jour*, 34 369-381, Apr 1936, *Trans Acad Med of Toronto*, 1932

2 DANDY, W E The Surgical Treatment of Ménière's Disease *Surg, Gynec and Obst.*, 72 421-425, Feb, 1941

3 Portmann, Georges Vertigo, Surgical Treatment by Opening the Saccus Endolymphaticus *Arch Otolaryngol*, 6 309 319, Oct, 1927

4 Hallpike, C S, and Cairns, H Observations on the Pathology of Ménière's Syndrome *Proc Roy Soc Med*, 31 1317 1336, Sept, 1938

5 Lindsay, J R Effect of Obliteration of the Endolymphatic Sac and Duct in the Monkey *Arch Otolaryngol*, 45 1 13, Jan, 1947

6 Anson B J, and Wilson, J G Form and Structure of Endolymphatic and Associated Ducts in the Child *Anat Rec* 65 485 498 July 25, 1936

7 Mollison, W W Surgical Treatment of Vertigo by Opening the External Semicircular Canal and Injecting Alcohol *Acta Otolaryngol*, 27 222 229, 1939

8 Wright, A J Labyrinthine Destruction in the Treatment of Vertigo by Injection of Alcohol Through the Oval Window *Jour Laryngol and Otol*, 53 591 597 Sept 1938, and Ménière's Disease Alcohol Injection of the Labyrinth *Jour Laryngol and Otol* 57 120 122, Feb, 1942

9 McDowall, G D Surgery of Ménière's Disease *Jour Laryngol and Otol*, 59 420 423, June, 1948

10 Cawthorne, Terence Ménière's Disease *Ann Otol, Rhinol and Laryngol*, 56 18 39, Mar, 1947

11 Day, Kenneth M Hydrops of the Labyrinth (Ménière's Disease) The Laryngoscope, 56 33 42, Feb, 1946

12 McNally, Wm J In discussion of paper on "Experimental Electrocoagulation of the Membranous Labyrinth in the Rhesus Monkey,' by LeRoy A Schall and J H Tom Rambo To appear in *Transactions of American Otological Society* Vol 36, 1948

13 Ireland, P E The Diagnosis and Treatment of Ménière's Symptom Complex *Canad Med Assn Jour*, 58 269 273, 1948

14 Lindsay, J R Healing of Experimental Labyrinthine Fistulas *Arch Otolaryngol*, 46 581 600, Nov, 1947

15 Schall, LeRoy A and Rambo, J H Tom Experimental Electrocoagulation of the Membranous Labyrinth in the Rhesus Monkey Presented before the American Otological Society in Hot Springs, Va April 14, 1948

THE ROLE OF VIRUS INFECTIONS IN THE ETIOLOGY OF SEROUS OTITIS MEDIA

HAROLD G TOBEY, M D ,
Boston, Mass

The increasing incidence of secretory otitis media in the last few years has led to a renewed interest in the etiology, diagnosis and treatment of this disease The diagnosis, which it would seem should be simple and self-evident, is frequently difficult and often escapes the attention of the examiner

Hoople,[1] in relating his experience in otolaryngology during the late war, chose this subject for discussion before the Royal Society of Medicine in London and stated that, in his opinion, it was the most frequently missed diagnosis in otology Eagle,[2] on noting a sudden increase in the disease, beginning about 1941, states "we are reluctant to admit that the disease had been prevalent in the years prior to 1941 and that our eyes are now seeing pathology which they had previously failed to see" Hantman,[3] in an excellent article in 1943, called to the attention of the Army Medical Corps the frequency of the disorder and the importance of the correct diagnosis

Since secretory otitis media has been for a long time a well recognized clinical entity, why should there have been a sudden increase in its incidence and an apparent difficulty in its recognition? The latter question may be answered by the fact that, although the disease has long been recognized, its incidence has been comparatively rare and usually recognized only when a fluid line could be distinctly seen through a transparent membrane To account for the unquestionable increase in the incidence of the affection, we must look for causes other than those which have been recognized in the past

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication Sept 1 1948

The commonly accepted etiology of serous otitis media is essentially mechanical — namely, an obstruction of the Eustachian tube due to a number of causes, such as the presence of adenoid tissue, or a tumor mass in the nasopharynx, infection of the nose, pharynx and sinuses, external pressure on the tube by swollen lymph nodes and, as pointed out by Robinson,[4] by passive congestion secondary to pressure on the pterygoid plexus

Aerotitis must be recognized as the outstanding example of the mechanics of the blocked tube, but the sequence of events is so rapid and the pressure changes so great in degree as to be in no way comparable to the much slower progression of an acute serous otitis media

It would seem questionable if obstruction of the tube, without any inflammation or irritation, could alone be a common cause of effusion into the middle ear The dry tube obstructed by a stricture, necessitating the use of forcible bouginage in order to open it, is very rarely the cause of such an effusion Even the classic example of effusion due to obstruction of the tube by malignant disease may be questioned — as witness, one patient suffering from this disease in whom the tube could be easily inflated In this instance the effusion must have been influenced by irritation from the advancing malignancy or interference with lymphatic drainage

Politzer[5] says, "Exudation into the tympanic cavity is most frequently caused by the inflammatory process of the mucous membrane itself, nevertheless, it is beyond doubt that sometimes in excess swelling of the tubal mucous membrane and impermeability of the Eustachian tube there occurs, in consequence of the consecutive rarefaction of the air in the tympanum, a transudation of serous fluid which is free of bacteria "

The common cold in the head, certainly the most frequent combination of infection, plus partial closure of the tube, has not in the past been a prolific cause of the effusion and does not account for the recent increase in the disease

In a search for other causes, two immediately come to mind first, avirulent infections which have long been considered as a contributory factor, second, new types of infections The possibility of allergy as a cause of the effusion has been kept in mind constantly and in no instance has it proved to be an etiologic factor

In regard to avirulent infections, there seems to have been a distinct decrease in the virulence and morbidity of acute otitis media during the last decade, analagous to that of scarlet fever which, likewise, has declined in virulence and morbidity and for no apparent cause

In reviewing the history of acute and subacute otitis media, there immediately comes to mind a picture of the virulent overwhelming infections of the middle ear and mastoid, with the constant threat of septicemia and meningitis which characterized the first quarter of this century The sudden onset with high fever, severe pain, early rupture of the drum, mastoid tenderness and postaural edema appearing in from three to five days from the onset, and the drooping of the canal wall, all conformed to the typical textbook picture which is so seldom seen today The streptococcus and pneumococcus were the prevailing organisms Shortly after World War I, a more insidious infection began to appear, which was due to the streptococcus mucosus capsulatus, now known to be the pneumocococus type III This infection was characterized by a slow, insidious onset with gradual involvement of the mastoid from the antrum outward to the cortex, with mastoid tenderness and edema only becoming evident as late as the second to fourth week Frequently the duration of the infection and repeated X-ray examinations were the only indications of the progress of the disease

During the 'thirties, coincident with the subsidence of the virulence of these infections, there began to appear more conservatism in performing paracenteses At the Children's Hospital in Boston a rule was put into effect that no paracentesis should be performed without examination and consent by the department of otology — whereas, it had previously been the custom for the medical resident to perform the operation on any drum membrane which appeared to be inflamed The result was an immediate decrease in the incidence of suppurative otitis media and mastoiditis At about this time, also, the necessity for ligating the jugular vein was being questioned more often

We then arrive at the period ushered in by the introduction of chemotherapy in about 1936 Although experimental work had been carried on for several years before 1936, it was not until 1938 that the use of these drugs became at all general The first drugs proved to be somewhat toxic and it was advisable to hospitalize all patients for careful observation during its administration New preparations were rapidly introduced, each one less toxic than its predecessor In order, they were prontosil, sulfanilamide, sulfapyridine, sulfathiazole and sulfadiazine

During 1941 there was a marked decrease in the number of simple mastoidectomies performed At the Massachusetts Eye and Ear Infirmary the number dropped to 36 per cent below the previous 10-year average, at the private ward of the Childrens' Hospital to 56 per cent below the 10-year average At the former institution this loss has held and has even increased up to the present time At first glance, one could give the entire credit for this decrease to the new drugs, but it must be remembered that at that period we were feeling our way in their use in constant fear of their toxicity and they were not prescribed as freely as is now possible with penicillin Warnings of the masking effects of the drugs were also frequent

Many have suspected that we have been passing through a period of avirulent infections Butler,[6] in the late 'thirties, had occasion to compare the results of treatments, with and without chemotherapy, in two small series of acute suppurative otitis media and found the incidence of operative mastoiditis to be the same in each series, therefore, as chief of otolaryngology in a large station hospital from September, 1942, to March, 1944, he instituted a nonchemotherapeutic regime for the treatment of acute middle ear infections — needless to say with consent from higher authority He reports "In this series of 610 cases of myringitis, exudative otitis media and purulent otitis media, treated without sulfonamides or penicillin, only two surgical mastoidectomies were necessary If only the 461 cases of purulent otitis media are considered in regard to the two mastoidectomies, it would seem that the morbidity of ear infections had paralleled the known decrease in the morbidity of such conditions as measles and scarlet fever "

It must be understood that in this argument to establish the probability of a period of avirulent infections during the last few years, it is not in any way meant to minimize the importance and advantages of chemotherapeutic agents and antibiotics in combating infection

If, then, we may assume that we have been experiencing a period of avirulent infections, perhaps a cyclic change such as has been noted in previous decades, the increased incidence of serous otitis media can be explained, and especially so if serous, exudative and suppurative otitis media are considered as sequential stages of the same process It is only fair to state, however, that at the present moment there are indications of an increasing virulence of these infections

As to the possibility of new types of infections It has been interesting through the years to observe the protean manifestations of the "grippe" or influenza epidemics, each of the same general pattern but exhibiting some bizarre symptom such as tenderness of the scalp, neuralgia of the face, frontal or occipital headache and various myalgias peculiar to the particular season

Of late years, however, there has developed a type of upper respiratory disease which is typical of neither influenza nor of the common cold, and is characterized by the prominence of pharyngitis and tracheitis, with a relatively insignificant coryza During the winters of 1945-1946 and 1946-1947, many patients presented themselves, complaining bitterly of dysphagia of four to five days' duration, yet on examination the pharynx appeared to be perfectly normal This period proved to be a sort of prodromal stage to a very evident pharyngitis and tracheitis with severe cough, while nasal and nasopharyngeal involvement was very mild Malaise has been a prominent symptom — the temperature normal or only very slightly elevated — leucocyte counts normal or subnormal The course of the disease has been prolonged and erratic, with frequent and irregular exacerbations, and the prolonged cough has suggested the possibility of a primary atypical pneumonia Secretory otitis media has been a frequent accompaniment of this infection and, indeed, three instances have been noted in which the ear symptoms have preceded the onset of the pharyngitis and tracheitis

Recent investigations have defined a new type of infection with symptoms similar to those just described Enders,[7] in a "Review of Some Recently Defined Virus Diseases," before the Massachusetts Medical Society in May, 1947, had this to say "During the decade 1920-1930 when I first began the study of infectious agents, it was more or less generally agreed that the era of etiologic discovery, if not definitely ended, was at least in its final stage The efforts of bacteriologists in the future were to be directed to the more intensive study of the known pathogenic organisms — the number of which would not be materially increased — with a view to defining more precisely their metabolism, their chemistry, the immune reactions that they elicited and the means by which their attack might be prevented or withstood, however, we failed to visualize that rapid extension of its boundaries that was so soon to come Since 1930, not only have the causative agents of such old and important diseases as yellow fever, influenza and mumps been determined, but also the etiology of a large group of other infectious maladies, many of which had been clinically unrecognized, has been established "

He then gives a list of seven diseases in man for which, within the period from 1940 to 1946, either conclusive or presumptive evidence of viral etiology has been presented Among these is primary atypical pneumonia

"After this list was prepared, a new virus disease was reported by a group of workers in Tennessee An outbreak of epidemic meningoencephalitis accompanied by vesicular pharyngitis affected over 200 persons, and inoculation of filtrates of nasopharyngeal washings from certain patients into the embryonated egg resulted in the isolation of what is tentatively described as a virus differing from any of the known agents"

The etiology of primary atypical pneumonia had presented a baffling problem to investigators ever since this condition had been recognized as a clinical entity in the years just preceding the war

"Accordingly, the Commission on Respiratory Diseases, located during the war at Fort Bragg, N C, undertook experiments in human volunteers with the objective of proving whether the agent was transmissible and filterable The results of these elaborate and costy experiments leave no reasonable doubt, I believe, that atypical pneumonia in which none of the known bacterial, fungal, viral or rickettsial agents can be demonstrated is due to a filterable virus

"The Commission also concerned itself with the relation between two other frequent clinical types of acute respiratory illness and their etiologies Thus, in additional experiments with 42 vounteers, they inoculated material obtained from a person with symptoms mainly of coryza — that is, those of the common cold and with minimal signs of pharyngeal inflammation Another group was inoculated with material from a patient with an infection distinguished from the common cold principally by sore throat and little nasal involvement The results indicated clearly that both these clinical types of infection could be experimentally transmitted to human beings by means of filtrates of throat washings The most interesting finding, perhaps, was the difference in the incubation period of the two types of experimentally induced diseases The coryzal syndrome had an incubation period of one or two days — an observation in agreement with earlier work on the common cold by Dochez and others In contrast, the disease characterized chiefly by inflammation of the pharynx had an incubation period of five or six days It will be noted that both these periods of incubation were shorter than that of the experimental atypical pneumonia Worthy of emphasis, too, is the finding that no immunity apparently resulted from the experimental coryzal infection, since reinoculation within three weeks with active material from patients who had recovered again induced the disease On the other hand, the pharyngitis virus produced a specifically increased resistance following reinoculation Neither the common cold nor the pharyngitic syndrome induced immunity against experimental inoculation of material containing the virus of atypical pneumonia The participation of hemolytic streptococci or influenza virus in either type of infection was satisfactorily eliminated as a possibility"

It is interesting to note that the pharyngeal type of infection with an incubation period of five to six days corresponds to the type previously described which is characterized by several days of severe dysphagia with negative findings and was considered to be the prodromal stage of an upper respiratory infection frequently foreboding a secretory otitis media

The majority of these patients are seen during the period of effusion with its characteristic symptoms, but fortunately there have been numerous opportunities of observing the process from the very beginning and the sequence of events resolves itself into three stages

1 A short period of mild pain or aching, accompanied by a sense of fullness in the ear

2 An increasing hyperemia of the mucous membrane of the middle ear

3 The period of effusion

I If the patient is examined a short time after the onset of the mild pain and sense of fullness in the ear, there will be observed an injection confined to the region of Shrapnell's membrane and at times extending to the upper posterior quadrant — rarely, if ever, does it extend beyond this area, if so, we are probably dealing with an exudative type of infection The rest of the membrane is essentially normal, retaining its luster and the light reflex remaining normal for that particular membrane The pain is never as severe as that encountered in the "influenzal ear" or acute myringitis and there is no tendency toward the formation of blebs The hearing is essentially normal and the tube inflates readily At this point the process may tend to resolve, if not it progresses to the second stage of increasing hyperemia of the mucous membrane of the midle ear The injection of the drum membrane, meanwhile, shows no tendency to spread and may, indeed, decrease in extent At this stage, the process is also still capable of resolution, but more frequently goes on to stage III — of effusion

It will be observed that the above discription is applicable only in the presence of a normal drum membrane through which the fluid line can be seen It may be, perhaps, that some of the difficulty in diagnosis occurs in the presence of a membrane which is opaque or abnormally scarred and retracted and through which it is impossible to detect the presence of the fluid It is well, therefore, to keep in mind the symptoms which are typical of the affection These are a persistent sense of fullness and deafness in the ear, which at times may be relieved by positional changes of the head, an occasional "crackling" sound which is caused by air entering the middle ear and bubbling up through the fluid Not infrequently the patient makes his own diagnosis when he complains of a sensation as of "water in the ear," such as is experienced after swimming, also, a frequent complaint is of a sensation of movement in the ear, as of a bubble in motion The diagnosis may be aided by inflation when a sound as of air bubbling through fluid may be auscultated, but this seems only to occur when the fluid covers the opening of the tube into the middle ear, and if this sign is depended upon and fails, the presence of the fluid may be overlooked

The history also is of extreme importance Frequently the discomfort experienced from a small amount of fluid in the ear is so slight that many weeks and even months may have passed before relief is sought, careful questioning, however will elicit a history of an acute respiratory infection which also may have been so mild and evanescent as to have escaped the memory of the patient

Given a history of infection plus the symptoms as described above, which do not clear up promptly under proper treatment, then an exploratory puncture, followed by suction with the Siegel otoscope, will often result in the evacuation of the fluid, much to the satisfaction of the operator and relief to the patient Such a sequence of events up to but not including the paracentesis could well be assumed to constitute a symptom complex which is indicative of a serous otitis media

It is hoped that enough evidence has been adduced to indicate that acute and subacute serous otitis media, in the majority of cases, is caused by a specific avirulent infection of the mucous membrane of the middle ear, originating perhaps in the upper respiratory tract and extending into the middle ear through the Eustachian tube or by a new type of infection, a virus peculiar to the pharynx and which, at times, seems to be primary in the middle ear itself, and that obstruction of the much maligned Eustachian tube is of secondary importance

This concept is important in regard to treatment which should be directed, in the first instance, to the upper respiratory infection and at the same time with frequent inflations of the ear by the Politzer method, rarely is it necessary to resort to the catheter The danger of introducing suppurative infection into the middle ear in this affection by inflation was disproved by both Politzer and Bezold years ago During the third stage of effusion, treatment should be directed primarily to the middle ear, but any remaining infection of the pharynx should not be neglected If the amount of fluid is small, it may yet be absorbed or, theoretically, be drained through the tube into the pharynx, although the latter possibility is doubtful, and treatment directed to the tube alone will be found to be ineffective The most effective procedure is to evacuate the fluid from the tympanum by aspiration with a syringe, or what will be found to be more effective, puncture of the membrane, followed by suction with the Siegel otoscope and Politzerization. This pinpoint puncture is sealed over within a few hours, but if not, and drainage continues for several days, the presence of a low grade suppurative infection should be strongly suspected.

It will be found that, as a rule, the less the amount of fluid the more quickly is the condition healed and that one treatment as outlined will frequently suffice; in others, several treatments are necessary. In a few instances, however, the fluid persists for an indefinite period in spite of repeated evacuations, which circumstances leads to a consideration of the involvement of the mucous membrane of the mastoid process.

In 1922, Jervey[8] reported a case of "mastoiditis hyperplastica Serosa," in which he queried, "If serous labyrinthitis why not serous mastoiditis?" Lawson,[9] in 1927, also reported a case of "serous otitis media" with involvement of the mastoid, both cases being cured following a simple mastoidectomy. Lowy,[10] as quoted by Hantman, states that the cells of the mastoid process are practically always filled with exudate and on X-ray there may be shading of the whole pneumatic system. Cody[11] similarly, in 1941, reported four instances of involvement of the mastoid which were relieved by operation. A further report on several cases may help to emphasize some of the salient features of the disease.

H. D. S., male, age 58 years, was first seen on Oct. 13, 1939, complaining of a blocking and sensation of motion in the ear for several weeks following a cold in the head. On examination all signs of the upper respiratory infection were absent, the membrana tympani was within normal limits and no evidence of fluid could be seen. The middle ear was inflated readily without signs indicative of fluid and the relief was immediate. Four days later he reported with the same symptoms, when, following inflation, a fluid line appeared at the level of the umbo and could be seen to ascend and disappear into the region of the aditus. The membrane was then punctured and considerable serous fluid evacuated. This sequence of events occurred at two-day intervals for two weeks, at which time all objective signs of fluid had disappeared, although he continued to complain bitterly of the sense of blocking and fullness over the entire side of the head, which was relieved only momentarily by the inflation.

Two weeks later, or four weeks after the first examination, the fluid was again evident, showing the same characteristic location in the upper posterior quadrant and on evacuation seemed to be in greater quantity than could be accounted for by the capacity of the middle ear cavity X ray examination at this time disclosed a definite clouding of the entire mastoid without any evidence of destruction The status remained the same for the next four weeks, with recurrent evacuation of the fluid a series of three X ray treatments were of no benefit, the fluid remained serous in character, cultures were negative, the temperature remained normal, no leucocytosis, and there was no mastoid tenderness Operation was advised and accepted At operation the cortex was found to be thin and extremely hard the cell walls were hard and brittle except in the region immediately surrounding the antrum where they were slightly softened, the mucous membrane lining throughout was edematous and slightly hemorrhagic especially in the cells extending from the antrum to the tip of the mastoid and in the posterior tip cells, while that of the antrum itself and the attic remained thin, white and perfectly normal in every respect Recovery was rapid and without incident The cultures were negative and the pathological report was serous mastoiditis without evidence of malignancy There has been no recurrence of the disease and the hearing remains essentially normal for his age at a level of 5 db below the unaffected ear

F D A male, age 53 years was subjected to annual infections of both maxillary sinuses for years In 1925 an intranasal antrotomy had been performed, and in 1926 an infected cyst removed from the right antrum by the Caldwell Luc approach nevertheless, the yearly attacks continued as usual In February, 1937, and May, 1942, he suffered his first attacks of serous otitis media, both of which responded promptly to treatment In August 1943, following an air flight he again had a serous effusion into the right antrum which resisted all treatment up to March 1944 These treatments consisted mainly of inflations several paracenteses one course of sulfonamides and one of penicillin, as well as two with diathermy, the second of which was followed by a severe vertigo of one hour s duration From January to March, 1945 the fluid was constantly present but healed spontaneously During June and July 1945 he received three radium treatments to the nasopharynx during a period of quiescence During December, 1945, in conjunction with an acute sinusitis the fluid recurred and again resisted all treatments X ray revealed an increased density of the mastoid with no evidence of destruction or decalcification At operation, the cortex was found to be extremely hard, the cell walls were not decalcified and the mucous membrane very edematous, except in the region of the antrum

In both instances the middle ear seemed to act as a receptacle to receive the overflow from the affected mastoid cells The pathology was reported as a serous mastoiditis and the bacteriological report was negative

Mrs A L age 24 years was first seen on April 1 1947 complaining of a "dull throbbing" and full sensation in the left ear which had been present for nearly nine weeks following the use of the telephone although at that time she was not conscious of any acoustic trauma and there was no history of an acute cold Except for a slight injection of the handle of the malleus the examination at that time was essentially negative there was no evidence of a subacute respiratory infection the drum membrane was within normal limits and the tube was patent The hearing was essentially normal a whisper being heard at 15 feet Two weeks later she again reported with the same symptoms, but somewhat more pronounced At this time, the membrane appeared flat, grayish and thick and puncture of the membrane followed by Politzerization through an easily inflatable tube evacuated a few drops of clear thick mucus Three days later, there was still a slight discharge a fact of some significance in that in the purely serous affection the puncture wound tends to close in a few hours Penicillin treatment was begun then with 300 000 units in wax on two successive days followed by 200 000 units by mouth every four hours for one week with what appeared at first to be some improvement but which proved to be only temporary although the discharge ceased Another paracentesis disclosed a thick cloudy mucoid discharge the culture from which was reported as staphylococcus albus The X ray revealed a diffusely clouded mastoid without evidence of destruction in any way comparable to the serous type but operation disclosed a broken down mastoid process with granulations on both the sinus and the dura A large amount of thick mucoid material was removed from the attic and middle ear by suction The culture from the mastoid proved to be sterile probably due to the action of the penicillin

This case is cited to illustrate the similarity in the time element and symptoms of the two affections, the difference being in the appearance of the drum membrane and the character of the discharge

BIBLIOGRAPHY

1 Hoople G D An Otolaryngologist s Experience in World War II *Trans Am Laryngol Rhinol and Otol Soc Inc* pp 183 191 1946

2 Eagle W W Secretory Otitis Media *Trans Am Laryngol Rhinol and Otol Soc, Inc* pp 23-36 1946

3 Hantman Capt I Secretory Otitis Media *Arch Otolaryngol.,* 38 561 573 1943

4 Robinson J M Subacute Catarrhal Otitis Media and Mastoiditis with Effusion *South Med Jour* 35 815 825 Sept 1942

5 Politzer Adam Diseases of the Ear p 273

6 Butler, H Personal communication.

7 Enders J F Review of Some Recently Defined Virus Diseases *N Eng Jour Med.,* 237 24 897 900 Dec. 11, 1947

8 Jervey J W Mastoiditis Hyperplastic Serosa *Jour A M A.,* 79 105 377-379 July 29 1922

9 Lawson, J L Secretory Otitis Media *Arch Otolaryngol.,* 6 346-352 1927

10 Lowy K. Concerning the Pathology of Secretory Otitis Media. *Monatsschr Ohrenheilk.,* 72 40 1938

11 Cody C C Jr. Acute Catarrhal Mastoiditis *Tex Stubs from Med.,* 37 233 236 July 1941

403 Commonwealth

appearance. This patient developed mucus fistulas of the type described by Volkmann.[10] Another had recurrent swellings followed by permanent enlargement of the lip associated with facial paralysis. All these cases showed the same underlying pathological changes in the tissue of the enlarged lip, namely, hyperplasia of the labial salivary glands. In one case there was an associated paralysis of the facial nerve. Microscopy revealed, in addition, a diffuse inflammation of the submucous tissue. Conway[9] prefers to classify these three cases as "hyperplasia of the labial salivary glands" rather than the older term, "cheilitis glandularis," recognizing that the hyperplasia may occur either with or without evidence of inflammation. Kettel[11] describes a condition known as Melkersson's syndrome, consisting of *1* peripheral facial palsy, which may be familial and which may show a tendency to relapse, *2* angioneurotic facial edema, and *3* lingua aplicata.

HISTORICAL

Inflammation of the lips, or cheilitis, has been described as early as 1682 by C. Stalpartius Van der Wiel.[12]

Bouisson,[13] in 1869, referred to tumors of the labial salivary glands and states that, as yet, these conditions have not been subjected to precise observations. In 1870, Volkmann[8] gave the name of cheilitis glandularis apostomatosa or myxadenitis to a syndrome which he had observed in five cases, three of which had syphilis. The lower lip was affected in all five. On examination these cases showed that the salivary glands of the lip had become "hempseed size," were swollen and were palpable as uneven masses in unusual number. On everting the mucosa of the lip, the excretory ducts appeared so dilated that a probe could be inserted. On moderate pressure an opaque mucous or purulent secretion could be expressed.

The acute circumscribed swelling described by Quincke,[14] in 1882, corresponds with the onset of macrocheilia, but Quincke did not mention the residual enlargement. In Quincke's edema,[14] although the swelling has a preference for certain regions, such as the eyelids, cheeks, lips and hands, it does not always recur in the same area.

Wright,[15] in 1884, described a case in an 18-year-old boy who had a swelling of the lip which had been present since birth The glands were palpable beneath the intact mucosa Successful removal was performed by a two-stage operation Microscopic examination was not made

Prior to the discovery of the spirocheta pallida and the serologic reactions for syphilis, and before the advent of modern therapy for lues, many considered syphilis one of the principal causes of elephantiasis of the lips Macrocheilia was frequently associated with syphilis In 1888, Mracek and Long[16] described a chronic edematous condition of the lips

In 1892, Miles[17] reported a case of enlargement of the upper lip, which on gross examination showed the labial glands to be hypertrophied The same year, Fraenkel[18] attached the name macrocheilia to an enlargement of the lower lip due to an adenomatous tumor of this region The gross specimen was described as a "pearl-like string of tumors" This occurred in a 19-year-old boy and had been present since the age of four years Hubschmann,[19] in 1894, and Rossolino,[20] in 1901, reported some cases in which, besides relapsing facial palsy, there was transient facial edema involving the lips

In 1901, Tourniére,[21] under the title of diffuse hypertrophic syphiloma, described macrocheilia as syphilitic elephantiasis

In 1904, Eisendrather[22] reported the case of a 16-year-old boy who had swelling of the lips since the age of 10 years Microscopical examination of tissue removed showed "normal labial mucous gland substance" There was associated ptosis of both eyelids

In 1905, Lindenberger[23] described the case of a man in whom the swelling followed a blow received on the lip 15 years earlier Gross pathological examination revealed a number of small glands "slightly larger than buckshot" No microscopic examination was made About the same time, Donati[24] described the same condition in a 20-year-old man The swelling of the upper lip had been present for eight years The excess tissue was excised and tissue examination showed it was due to enlarged mucus glands Roussel,[25] in 1906, reported a case in which the lower lip had been swollen for three years Mucus fistulas and luetic skin lesions were also present Microscopic examination was not made

In 1911, Masera[26] reported two cases One was in a woman of 24, the other a youth of 19 Pathological examination showed the tissue to be composed chiefly of acinous labial glands with many excretory ducts This writer believed the macrocheilia to be due to hypertrophy and hyperplasia of the labial mucus glands

In 1915, Stelwagon[27] suggested that the enlargement of the lip was due to adenoma of the mucous glands of the lip, and was not due to syphilis

In 1920, Ascher[6] described a case presenting the syndrome of blephrochalasis, struma and double lip Wirth[28] presented a similar case with lid changes and double lip without enlargement of the thyroid gland In 1920, Sutton[29] described a case of macrocheilia of the upper lip due to ademnoma of the mucus glands in a man of 26 Microscopic examination showed numerous mucus glands

In 1921, Weve[30] reported a patient with Ascher syndrome in a case of a 27-year-old healthy soldier who showed blephrochalasis and double lip Both had been present since the patient was four years old

Ascher (1922) described two additional cases of the same syndrome One was in a 16-year-old girl, the other a man of 39 who had swelling of the eyelids, double lips and painless swelling of both parotid glands

Dorrance[31] (1922) reported a case of double lip of nine years' duration in a patient 21 years of age Gross examination of the specimen from the upper lip revealed enlargement of the labial salivary glands Microscopic examination was not reported In 1922, Roedelius[32] described a case of macrocheilia of the lower lip with several sinuses which admitted a probe and through which mucus discharged This patient was a 45-year-old man The enlargement of the lip had been present since childhood In infancy this patient had had an operation for harelip Roedelius advanced the opinion that in patients with congenital harelip the protrusion of the lower lip might be a factor in exciting activity of the mucus glands, thus adding to their overgrowth In 1928, Melkersson[33] presented his syndrome of *a* peripheral facial palsy, *b* angioneurotic facial edema, and *c* lingua plicata In 1930, Myer[34] reported two cases — one in a 10-year-old boy, the other in a woman of 36 This was associated with marked abnormality in the shape of the alveolar process of the upper jaw in both cases Histlogical examination showed the membrane, the labial glands and the surrounding tissues to be normal

Rosenstein[35] (1932) reported a case of Ascher's syndrome in a 16-year-old girl In this patient there was enlargement of both lips, a tendency to hyperthyroidism and enlargement of the eyelids Because of the enlargement of the lips developed at the onset of menstruation, Rosenstein believed the macrocheilia to be due to disturbance of the endocrine glands In 1933, Bejarano[36] reported two cases of cheilitis glandularis associated with epithelioma In both cases the lower lip was involved The author does not believe that the cheilitis was a genetic factor in epithelioma of the lip

Touraine and Solenter[37] (1933-1935) described two cases and reviewed 41 cases from the literature In both of their cases the lower lip was involved, one was of six months' duration in a woman of 60 In the former, a spindle cell epithelioma was found at the base of the infundibulum Out of the 41 cases in the literature they reviewed, 12 per cent showed malignant changes and were considered by them as precancerous

In 1933, Eitner[38] reported nine cases, of which three showed enlargements of the eyelids, in addition to the double lips, but none exhibited an enlargement of the thyroid gland The histopathological examination was not given In New and Kirch's[4] 61 cases mentioned above, the swelling of the face was distributed as followed Upper lip, 38 cases, nose, four cases, upper alveolar process, two cases In their report the authors make no mention of Ascher's cases, nor do they com-in which the lower lip had been swollen for three years Mucus fistulas and luetic skin lesions were also present Microscopic examination was not made

In 1911, Masera[26] reported two cases One was in a woman of 24, the other a youth of 19 Pathological examination showed the tissue to be composed chiefly of acinous labial glands with many excretory ducts This writer believed the macrocheilia to be due to hypertrophy and hyperplasia of the labial mucus glands

In 1915, Stelwagon[2] suggested that the enlargement of the lip was due to adenoma of the mucous glands of the lip, and was not due to syphilis

In 1920, Ascher[6] described a case presenting the syndrome of blephrochalasis, struma and double lip Wirth[28] presented a similar case with lid changes and double lip without enlargement of the thyroid gland In 1920, Sutton[29] described a case of macrocheilia of the upper lip due to ademnoma of the mucus glands in a man of 26 Microscopic examination showed numerous mucus glands

In 1921, Weve[30] reported a patient with Ascher syndrome in a case of a 27-year-old healthy soldier who showed blephrochalasis and double lip Both had been present since the patient was four years old

Ascher (1922) described two additional cases of the same syndrome One was in a 16-year-old girl, the other a man of 39 who had swelling of the eyelids, double lips and painless swelling of both parotid glands

Dorrance[31] (1922) reported a case of double lip of nine years' duration in a patient 21 years of age Gross examination of the specimen from the upper lip revealed enlargement of the labial salivary glands Microscopic examination was not reported In 1922, Roedelius[32] described a case of macrocheilia of the lower lip with several sinuses which admitted a probe and through which mucus discharged This patient was a 45-year-old man The enlargement of the lip had been present since childhood In infancy this patient had had an operation for harelip Roedelius advanced the opinion that in patients with congenital harelip the protrusion of the lower lip might be a factor in exciting activity of the mucus glands, thus adding to their overgrowth In 1928, Melkersson[33] presented his syndrome of *a* peripheral facial palsy, *b* angioneurotic facial edema, and *c* lingua plicata In 1930, Myer[34] reported two cases — one in a 10-year-old boy, the other in a woman of 36 This was associated with marked abnormality in the shape of the alveolar process of the upper jaw in both cases Histological examination showed the membrane, the labial glands and the surrounding tissues to be normal

Rosenstein[35] (1932) reported a case of Ascher's syndrome in a 16-year-old girl In this patient there was enlargement of both lips, a tendency to hyperthyroidism and enlargement of the eyelids Because of the enlargement of the lips developed at the onset of menstruation, Rosenstein believed the macrocheilia to be due to disturbance of the endocrine glands In 1933, Bejarano[36] reported two cases of cheilitis glandularis associated with epithelioma In both cases the lower lip was involved The author does not believe that the cheilitis was a genetic factor in epithelioma of the lip

Touraine and Solente[37] (1933-1935) described two cases and reviewed 41 cases from the literature In both of their cases the lower lip was involved, one was of six months' duration in a woman of 60 In the former, a spindle cell epithelioma was found at the base of the infundibulum Out of the 41 cases in the literature they reviewed, 12 per cent showed malignant changes and were considered by them as precancerous

In 1933, Eitner[38] reported nine cases, of which three showed enlargements of the eyelids, in addition to the double lips, but none exhibited an enlargement of the thyroid gland The histopathological examination was not given In New and Kirch's[4] 61 cases mentioned above, the swelling of the face was distributed as followed Upper lip, 38 cases, nose, four cases, upper alveolar process, two cases In their report the authors make no mention of Ascher's cases, nor do they comment on the simultaneous involvement of the lips and eyelids in the same patient As stated above, their pathological report is very meager Conway[5] is of the opinion that many cases of macrocheilia are due to hyperplasia of the labial salivary glands In discussion of the presentation of New and Kirch, Beck[30] mentioned three cases, two of which had a history of facial paralysis Kettel[11] states that in three of four cases macroscopic swelling was due to edema and chronic inflammation but not due to lymphatic stasis Dilated lymphatic vessels could be seen only in Case 4 Burkett[11a] (1946) reported a case of macrocheilia due to repeated streptococcal infections of the gums and lips

Incidence It is apparent that in most instances this condition (swelling of the lips and face) occurs mostly in the young Females appear to be less prone to the disease than males Many of these cases are associated with facial paralysis Conway reported three cases, with involvement of the facial nerve to one New and Kirch,[4] out of 67 cases, 13 per cent showed facial paralysis The ages of their patients at the occurrence of the first swelling ranged from four to 54 years Twenty-nine patients were less than 20 years of age, and 50 were less than 30 years The incidence by decades was as follows

One to 10 years, three cases, 11 to 20 years, 26 cases, 21 to 30 years, 21 cases, 31 to 40 years, 10 cases, 41 to 50 years, five cases, and 51 to 60 years, two cases There were 46 males and 21 females Thus it may be seen that the condition occurs predominantly in youth and in patients less than 30 years of age Males predominate over females in the ratio of better than two to one

ETIOLOGY

The cause of the condition is not known Its similarity in some respects to angioneurotic edema has been noted In angioneurotic edema there is involvement of other parts of the body than the face at the same time that the face is affected, but in the cases described above, only the face, mouth and throat were involved The common condition of edema as generally observed causes tenseness of the skin and pitting on pressure, but the residual swelling in these cases is soft and elastic There are no changes in the skin itself

The causative factors of this condition are purely theoretical New and Kirch state that one must consider, first, a disturbance of trophic, vasomotor or motor nerves, second, alterations in the metabolism or state of nutrition of the tissues, changing the power of the cell to attract, give off or retain fluid, third, some chemical disturbances in the cell of a complicated nature that changes the fluid balance, and fourth, a possible so-called vital secretory activity of the endothelial cells Kettel is of the opinion that the facial palsy, as well as the swelling of the face, is an angioneurotic phenomenon and the etiology must be sought in these factors which may cause a disurbance of the regulations of the vasomotor nerves

TREATMENT

New and Kirch advise the injection of boiling water, followed by radium application Three months later, this treatment may have to be repeated When there is no tendency to recurrence of the swelling for six months, the superfluous tissue of the lips or cheeks may be excised They state that it is essential, first, to eliminate the recurring swelling before attempting operation in order to prevent recurrence or prevent greater enlargement of the parts than was present before operation

Kettel performed excision only in Case 1, and the result was satisfactory In Case 5, despite preceding injection of boiling water and subsequent partial excision, there occurred another attack of acute edema, which, however, subsided Conway[5] reports the same experience From the above, one must conclude that excision may be done without preceding injection of boiling water or radium treatments, running the risk of recurrent swelling, as the treatment referred to by no means protects the patients against relapse Just how this ment on the simultaneous involvement of the lips and eyelids in the same patient As stated above, their pathological report is very meager Conway[5] is of the opinion that many cases of macrocheilia are due to hyperplasia of the labial salivary glands In discussion of the presentation of New and Kirch, Beck[30] mentioned three cases, two of which had a history of facial paralysis Kettel[11] states that in three of four cases macroscopic swelling was due to edema and chronic inflammation but not due to lymphatic stasis Dilated lymphatic vessels could be seen only in Case 4 Burkett[11a] (1946) reported a case of macrocheilia due to repeated streptococcal infections of the gums and lips

Incidence It is apparent that in most instances this condition (swelling of the lips and face) occurs mostly in the young Females appear to be less prone to the disease than males Many of these cases are associated with facial paralysis Conway[5] reported three cases, with involvement of the facial nerve to one New and Kirch,[4] out of 67 cases, 13 per cent showed facial paralysis The ages of their patients at the occurrence of the first swelling ranged from four to 54 years Twenty-nine patients were less than 20 years of age, and 50 were less than 30 years The incidence by decades was as follows

One to 10 years, three cases, 11 to 20 years, 26 cases, 21 to 30 years, 21 cases, 31 to 40 years, 10 cases, 41 to 50 years, five cases, and 51 to 60 years, two cases There were 46 males and 21 females Thus it may be seen that the condition occurs predominantly in youth and in patients less than 30 years of age Males predominate over females in the ratio of better than two to one

ETIOLOGY

The cause of the condition is not known Its similarity in some respects to angioneurotic edema has been noted In angioneurotic edema there is involvement of other parts of the body than the face at the same time that the face is affected, but in the cases described above, only the face, mouth taneously however the swelling never completely disappeared so that after each episode of swelling the lip remained a little larger than before For the past year the swelling receded but very little The present swelling came on four months ago and has so remained

P H Does not recall having any childhood diseases At the age of two years had fractured femur At the age of 12 patient developed poliomyelitis and was in the hospital for several years Patient had an appendectomy operation four years ago and a tonsillectomy one year ago

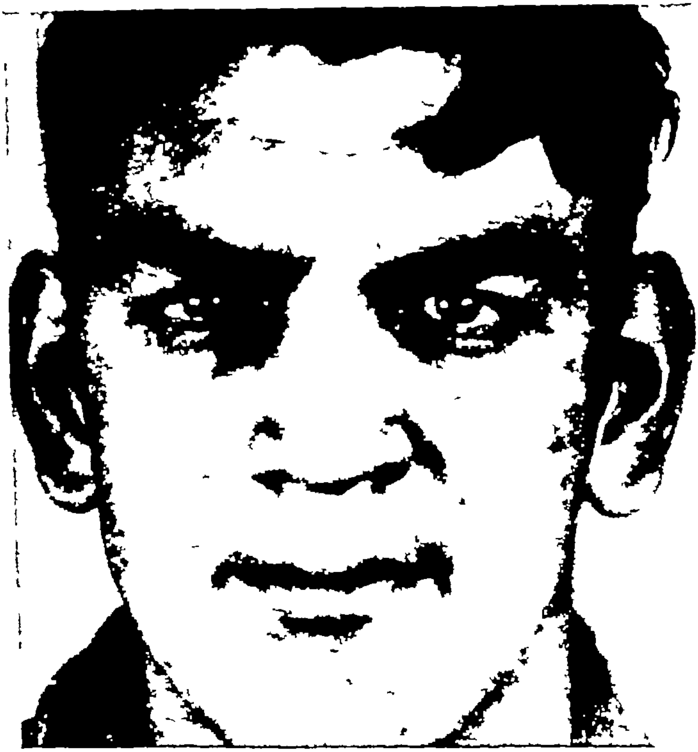


Fig 2 Appearance of the patient at present, approximately two years following treatment

P E Revealed a diffuse enlargement of the entire upper lip protruding markedly over the lower lip The swelling was not tender or painful and did not feel edematous On digital pressure the lip felt rather firm and in places 'shotty" The lip was dusky red in color and there were no ulcerations fissures or fistulas Repeated serologic and urine examinations were entirely negative treatment stops the swelling has not been explained It may be that the production of fibrosis of the lymph structures or changes in the cells themselves prevent swelling of the tissues, however, the results of this treatment have been satisfactory

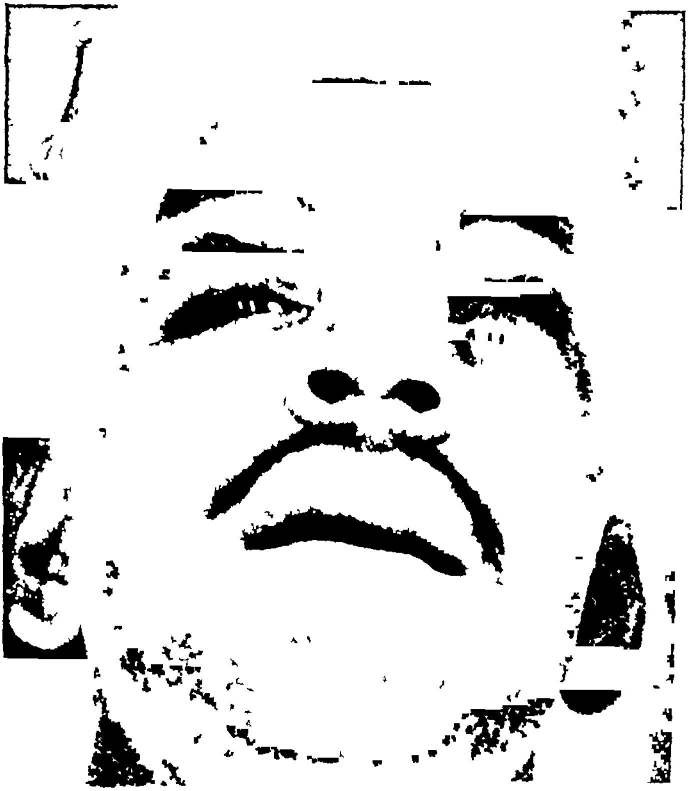


Fig 1 Appearance of patient on July 16 1946 following the injection of boiling water and prior to Roentgen and surgical treatment

REPORT OF A CASE

Male aged 24 Hospital No 1,211 596 Admitted to hospital on May 27, 1946

C C Swollen lip

P I The swelling of the upper lip appeared approximately 10 years ago The swelling which was never painful or tender would occur about every three months last from two to three days and disappear spon

3 The injection of boiling water followed by Roentgen therapy and surgical removal of excess tissue proved successful

REFERENCES

1 Wood F C Lymphangioma in Nelson Loose Leaf Surgery 2 45 1929

2 Ormsby O S A Practical Treatise on Diseases of the Skin 3rd ed. Philadelphia Lea and Febiger p 1219 1927

3 Bloodgood J C Lesions of the Oral Cavity in Lewis Practice of Surgery Chap 4 1930

4 New G B., and Kirch W H Permanent Enlargement of the Lips and Face Secondary to Recurring Swellings and Associated with Facial Paralysis *Jour A. M A.*, 100 1230 Apr 22 1933

5 Conway Herbert Macrocheilia Due to Hyperplasia of the Labial Salivary Gland Operative Correction *Surg Gynec. and Obst.*, 66 1024 June, 1938

6 Ascher, K. W Blepharochalasis mit Struma und Doppellippe *Klin Monatbl f Augenh.*, 65 86 Jan., 1920

7 *Idem* Das Syndrom Blepharochalasis mit Struma und Doppellippe *Klin Wchnschr.*, 1 2287 1922

8 Volkmann R Einige Falle von Cheilitis Glandularis Apostematosa Myxadenitis Labialis *Arch f Path Anat.*, 50 142 1870

9 Touraine, A., and Solente, G Cheilitis Glandularie (Maladie de Volkmann) *Bull Soc Franc de Dermat et Syph* 40 89 1933

10 *Idem* La Cheilite Glandulaire (Etat Precancereux de la Levre Inferieure) *Presse Med.*, 42 191 1934

11 Kettel, Karsten Melkersson s Syndrome Reports of Five Cases with Special Reference to the Pathologic Observations *Arch Otolaryngol* 46 34-36 Sept. 1947

11a Burkett L. W Oral Medicine Philadelphia J B Lippincott 1946

12 Van de Weil Cited by Touraine and Solente[9]

13 Bouisson E F Levres in Dict. Encycloped d sc med 2 Ser., 2 448 1869

14 Quincke *Monatssch., f Pract Dermat.*, p 129 1882

15 Wright J W A Case of Hypertrophy of the Mucous Glands of the Lips *New York Med Jour.*, 40 152 1884

16 Mracek and Long Cited by Petrov Sur l Elephantiasis Syphilitique *Ann d Mal Ven.*, 10 337-355 1915

17 Miles W E Hypertrophy of the Mucous Membrane of the Upper Lip *Lancet.*, 2 717 Sept 24 1892

18 Fraenkel, E Ueber einen Fall Von Makrocheilie durch adenome der Lippenschleimdrussen. *Arch f Klin Chir.*, 44 95 1892

19 Hubschmann P Ueber Recidivende und Diplegie Bei Der Sagenannten rheumatischen facialislahmung *Neurol Centralbl.*, 13 815 1894.

20 Rossolino G J Recidivirende Facialislahmung bei Migraine *Neurol Centralbl.*, 20 744 Aug 1901.

TREATMENT

May 28 1948 Under pentothal anesthesia 15 cc of boiling water were injected throughout the upper lip After the reaction had subsided the patient was referred to Dr Frederick W O Brien who is in charge of the tumor clinic and who carried out the Roentgen therapy He was kind enough to supply us with details of this treatment, which was as follows

"Re A E, Tumor Clinic, Boston City Hospital Referred to the tumor clinic July 15 1946 by Dr Garfin with diagnosis of lymphedema Had had injection of upper lip with boiling water one month before without appreciable reduction in size of lips

"Patient was given 2 000 r high voltage X rays with 1 13 mm cu in divided doses, 7 cm field between July 15, 1946, and Aug 5, 1946 at which time there had been an appreciable reduction in the size of the upper lip "

Operation was carried out on Nov 4, 1946 Under novocaine anesthesia a wedge shaped section of tissue was removed from the mucus surface of the upper lip down to the orbicular oris muscle Bleeding points were ligated with fine catgut sutures and the edges of the wound were approximated with one-end fine silk mattress sutures Following the operation patient was put on penicillin

Pathological report was as follows

'There is slight hyperkeratosis of the epithelium There is an increase of the submucosal fibrous tissue with large amounts of collagen There is moderate congestion of the blood vessels No edema of tissue is seen There is marked interstitial and perivascular infiltration with small round cells, macrophages and occasional polymorphonuclear neutrophilic leucocytes and plasma cells There is an apparent decrease in striated muscle fibres "

Diagnosis Chronic inflammation

Over two years have elapsed since the treatment was started, and except for one episode of swelling which followed the X-ray treatment, the swelling of the lip gradually receded and has remained entirely normal without any recurrent swelling during this period

SUMMARY

1 A report of a patient with macrocheilia has been presented

2 A review of the literature on macrocheilia reveals considerable differences of opinion as to the etiology and pathogenesis of this condition It is apparent that the pathogenesis is not the same in all cases of chronic enlargement of the lip In our case it was due to chronic inflammation

3 The injection of boiling water followed by Roentgen therapy and surgical removal of excess tissue proved successful

REFERENCES

1 Wood, F C Lymphangioma in Nelson Loose Leaf Surgery, 2 45, 1929

2 Ormsby, O S A Practical Treatise on Diseases of the Skin 3rd ed Philadelphia Lea and Febiger, p 1219, 1927

3 Bloodgeed, J C Lesions of the Oral Cavity M Lewis Practice of Surgery, Chap 4, 1930

4 New, G B and Kirch, W H Permanent Enlargement of the Lips and Face Secondary to Recurring Swellings and Associated with Facial Paralysis *Jour A M A.*, 100 1230, Apr 22, 1933

5 Conway, Herbert Macrocheilia Due to Hyperplasia of the Labial Salivary Gland Operative Correction *Surg, Gynec and Obst*, 66 1024, June, 1938

6 Ascher, K. W Blepharochalasis mit Struma und Doppellippe *Klin Monatbl f Aughenh*, 65 86, Jan 1920

7 *Idem* Das Syndrom Blepharochalasis mit Struma und Doppellippe *Klin Wchnschr*, 1 2287, 1922

8 Volkmann, R Einige Falle von Cheilitis Glandularis Apostematosa Myxadenitis Labialis *Arch f Path Anat*, 50 142, 1870

9 Touraine, A and Solente, G Cheilitis Glandularie (Maladie de Volkmann) *Bull Soc Franc de Dermat et Syph*, 40 89, 1933

10 *Idem* La Cheilite Glandulaire (Etat Precancereux de la Levre Inferieure) *Presse Med* 42 191 1934

11 Kettel, Karsten Melkersson's Syndrome Reports of Five Cases with Special Reference to the Pathologic Observations *Arch Otolaryngol*, 46 34-36, Sept 1947

11a Burkett, L W Oral Medicine Philadelphia J B Lippincott, 1946

12 Van de Weil Cited by Touraine and Solente[9]

13 Bouisson, E F Levres in Dict Encycloped d sc med 2 Ser, 2 448, 1869

14 Quincke *Monatssch, f Pract Dermat* p 129, 1882

15 Wright, J W A Case of Hypertrophy of the Mucous Glands of the Lips *New York Med Jour*, 40 152 1884

16 Mracek and Long Cited by Petrov Sur l'Elephantiasis Syphilitique *Ann d Mal Ven*, 10 337-355, 1915

17 Miles, W E Hypertrophy of the Mucous Membrane of the Upper Lip *Lancet*, 2 717 Sept 24 1892

18 Fraenkel, E Ueber einen Fall Von Makrocheilie durch adenome der Lippenschleimdrussen *Arch f Klin Chir* 44 95 1892

19 Hubschmann, P Ueber Recidivende und Diplegie Bei Der Sagenannten rheumatischen facialislahmung *Neurol Centralbl*, 13 815 1894

20 Rossolimo G J Recidivirende Facialislahmung bei Migraine *Neurol Centralbl*, 20 744, Aug 1901

all the tiny fragments of bone would be solidified into one solid mass within a few weeks

These encouraging and authoritative answers to our most obvious problems led us to attempt the obliteration of large frontal bone defects with bits of cancellous bone cut as small as possible We were amazed at the ease with which reconstruction could be carried out, and at the satisfactory results obtain from such a relatively simple procedure

Two illustrative cases are presented

Case 1 G J, No 45 834, a 36 year old white male was first admitted to the University Hospitals on Aug 27 1945, with a diagnosis of acute purulent frontal sinusitis (bilateral) complicated by fulminating acute osteomyelitis of the frontal bone At operation it was necessary to sacrifice both frontal sinuses in addition to the portion of the frontal bone forming the center one-half of the forehead The patient had an uneventful postoperative recovery and was observed for 28 months to make certain that no residual infection was present

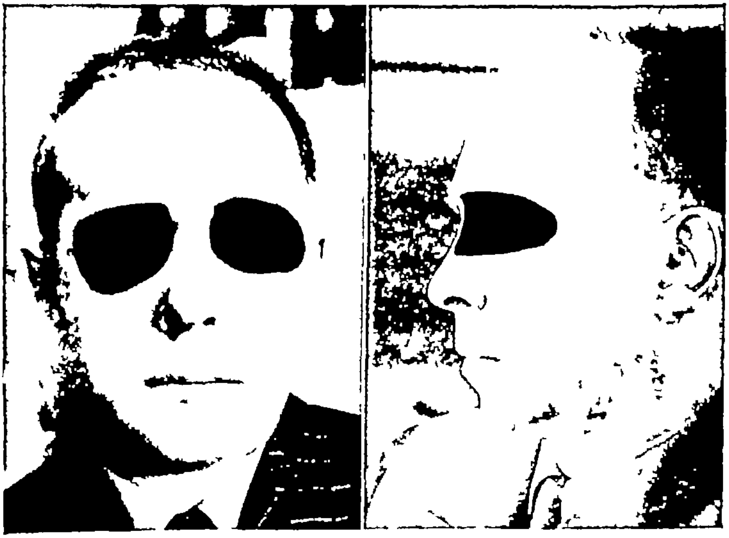


Fig 2

On Dec 9 1947, the patient was readmitted for obliteration of the frontal bone defect depicted in Fig 1

At operation a large amount of cancellous bone was removed from the posterolateral surface of the ilium The removed bone was then cut into

A SIMPLIFIED METHOD OF OBLITERATING FRONTAL BONE DEFECTS*

D M LIERLE, M D , and W C HUFFMAN, M D ,
Iowa City, Iowa

Reconstruction of the frontal area of the skull, following accidental trauma or operative procedures, has been described so often that one hesitates to comment further upon the subject

A complete review of surgical attacks devised and materials used to efface bony defects in this region would be far too unwieldy for a brief presentation In general, substances used fall into three main groups

1 Autografts (*e g* , bone, cartilage, fascia lata, or derma removed from the patient's own body)
2 Homografts (*e g* , preserved rib cartilage in strips or small fragments)
3 Various nonanimal products (*e g* , vitallium, tantalum and acrylic)

Although different metals and other synthetic products have been widely used and highly praised, we have questioned the advisability of using foreign materials in the human body no matter how nonirritating they seem Occasionally we have seen patients who have tolerated such implants poorly Some have been in the process of extruding them, with resulting inflammation of the overlying soft tissue Some have suffered psychic disturbances because of the knowledge that they were carrying extraneous substances in their skulls On such occasions we have regarded these materials with even greater timidity

In a lesser degree, we have questioned the desirability of cartilage homografts

---

*University Hospitals, Iowa City Iowa.

Editor's Note This ms. received in Laryngoscope Office and accepted for publication, Nov 24 1948

21 TOURNIERE, J A Traite de la Syphilis *Arch Derm and Syph*, Teriare Periode, Paris, J Rueff, pp 250 253, 1901

22 EISENDRATH, D N Adenoma of the Mucus Glands of the Lips as a Cause of Macrocheilia *Ann Surg* 40 320, Aug, 1904

23 LINDENBERGER A Case of Macrocheilia Due to Enlargement of the Mucus Glands of the Lip *Jour A M A*, 44 959 Mar 25, 1905

24 ROUSSEL, J N A Case of Cheilitis Glandularis *N Orleans Med and Surg Jour*, 58 739, Mar, 1906

25 DONATI, M Macrocheilia da Adenomi dell ghiandole mucose del labbro superiore gazz *Med Ital*, 56 71, 1905

26 MASERA G Due casi di macrocheilia del labbro superiore *Morgagni*, 52 p 1, 151, 1911

27 STELWAGON, H W Treatise on Diseases of Skin 7th ed Philadelphia W B Saunders Co, 1915

28 WIRTH Cheilitis glandularis apostematosa derat studien *Unna Festchrift*, 1 20 611

29 SUTTON, R L Cheilitis Glandularis Apostematosa with Case Report *Jour Cutan Dis*, 27 150, Apr 1909

30 WEYL H J M Cited by Ascher[6]

31 DORRANCE, G M Double Lip *Ann Surg*, 76 776 777, Dec, 1922

32 ROEDFLIUS Seltene Form der Macrocheilie *Klin Wchnschr*, 1 1097, May 27, 1922

33 MILKERSSON, E *Hygiea*, 90 737 1928

34 MEYER, H Die Doppellippe und ihre Behandlung *Deutsche Ztschr f Chir*, 222 305, Jan, 1930

35 ROSENSTEIN, M Blepharochalasis mit Struma und Doppellippen *Wien Klin Wchnschr*, 45 1017, Aug 5, 1932

36 BEJARANO, J La queilitis glandular como affeccion cancerigena accidental *Actas Dermo sif*, 26 535 1933 1934

37 TOURAINE and SOLENTE La cheilite glandulaire sa frequence son anciennete (Une observation du XVII Siecle) *Bull Soc Franc de Dermat et Syph*, p 42, May, 1935

38 EITNER, E Uber Doppellipe *Wien Med Wchnschr*, 83 429, Apr 8, 1933

39 BECK, J C Discussion of Presentation by B B New *Am Laryngol Assn*, 55 47, 1933

AMERICAN BOARD OF OTOLARYNGOLOGY

The American Board of Otolaryngology will conduct the following examinations in 1949

May 11 to 14 in New York, N Y, at the Biltmore Hotel

Oct 4 to 7 in Chicago, Ill, at the Palmer House

A SIMPLIFIED METHOD OF OBLITERATING FRONTAL BONE DEFECTS*

D M Lierle, M D, and W C Huffman, M D,
Iowa City, Iowa

Reconstruction of the frontal area of the skull, following accidental trauma or operative procedures, has been described so often that one hesitates to comment further upon the subject

A complete review of surgical attacks devised and materials used to efface bony defects in this region would be far too unwieldy for a brief presentation In general, substances used fall into three main groups

1 Autografts (*e g*, bone, cartilage, fascia lata, or derma removed from the patient's own body)
2 Homografts (*e g*, preserved rib cartilage in strips or small fragments)
3 Various nonanimal products (*e g*, vitalium, tantalum and acrylic)

Although different metals and other synthetic products have been widely used and highly praised, we have questioned the advisability of using foreign materials in the human body no matter how nonirritating they seem Occasionally we have seen patients who have tolerated such implants poorly Some have been in the process of extruding them, with resulting inflammation of the overlying soft tissue Some have suffered psychic disturbances because of the knowledge that they were carrying extraneous substances in their skulls On such occasions we have regarded these materials with even greater timidity

In a lesser degree, we have questioned the desirability of cartilage homografts

---

*University Hospitals, Iowa City Iowa.

Editor's Note This ms. received in Laryngoscope Office and accepted for publication, Nov 24 1948

Our choice of autografts is reduced to two skeletal tissues, bone and cartilage Of the two, our choice is overwhelmingly in favor of bone Our choice of bone, to be used whenever feasible, will be questioned by those who favor cartilage just as strongly, our adoption of cancellous bone is probably influenced by personal preference, but over the years we have been increasingly impressed by its favorable properties We regard cancellous bone highly because of its availability in large amounts, its workability, and the almost certain assurance of firm fixation after transplantation

Once the decision to use bone as a graft is made, it may be employed in one of three forms

1 As a single plate
2 As strips
3 As chips of moderate size (1 cm or larger)

When a large skull defect is present it is often difficult to find a plate of bone large enough to fill it, and one which may be pared to the proper contour, in addition, there is usually the problem of preventing a dead space beneath the graft This issue is also present when curved strips are used, and further trouble is encountered when one tries to fit the strips together in such a way that the forehead will not have a corrugated surface

The use of chips to fill a defect is technically less demanding than the modeling of a plate or strips, but if they are of appreciable size, and especially if every chip is in contact with the recipient bed, it is difficult to arrange them so that a smooth and convex surface results

Obviously, the simplest way to achieve a proper bony contour would be to cut the osseous graft into extremely minute particles and insert them into a previously prepared pocket — much like "stuffing feathers into a pillow" The amount and distribution of this easily molded material could be determined by external manipulation, and should result in a surface of any desired shape

Two questions immediately arise concerning the use of bone about the skull in such a manner will the resulting bulk of bone have a deleterious effect on the intracranial contents because of direct irritation and/or pressure? Will the small particles of bone in the center of the transplanted mass remain viable long enough for a blood supply to be derived from the peripheral recipient bed?

In regard to the first question, we consulted Dr Russell Meyers, of the Division of Neurosurgery, University Hospital, who felt that no damage to the brain would result from such a procedure, especially if the graft could be laid on top of the greatly thickened dura that results from a healed inflammatory process

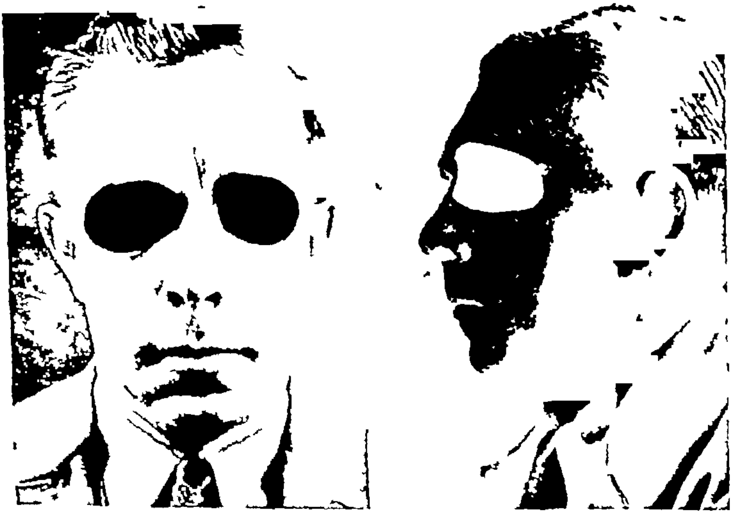


Fig 1

In answer to the second question, Dr Arthur Steindler, of the Department of Orthopedic Surgery, assured us that we need have little fear of losing the deep particles of the graft because of inadequate blood supply He not only felt that adequate nutrition would be obtained, but was convinced that

Our choice of autografts is reduced to two skeletal tissues, bone and cartilage Of the two, our choice is overwhelmingly in favor of bone Our choice of bone, to be used whenever feasible, will be questioned by those who favor cartilage just as strongly, our adoption of cancellous bone is probably influenced by personal preference, but over the years we have been increasingly impressed by its favorable properties We regard cancellous bone highly because of its availability in large amounts, its workability, and the almost certain assurance of firm fixation after transplantation

Once the decision to use bone as a graft is made, it may be employed in one of three forms

1 As a single plate
2 As strips
3 As chips of moderate size (1 cm or larger)

When a large skull defect is present it is often difficult to find a plate of bone large enough to fill it, and one which may be pared to the proper contour, in addition, there is usually the problem of preventing a dead space beneath the graft This issue is also present when curved strips are used, and further trouble is encountered when one tries to fit the strips together in such a way that the forehead will not have a corrugated surface

The use of chips to fill a defect is technically less demanding than the modeling of a plate or strips, but if they are of appreciable size, and especially if every chip is in contact with the recipient bed, it is difficult to arrange them so that a smooth and convex surface results

Obviously, the simplest way to achieve a proper bony contour would be to cut the osseous graft into extremely minute particles and insert them into a previously prepared pocket — much like "stuffing feathers into a pillow" The amount and distribution of this easily molded material could be determined by external manipulation, and should result in a surface of any desired shape

Two questions immediately arise concerning the use of bone about the skull in such a manner will the resulting bulk of bone have a deleterious effect on the intracranial contents because of direct irritation and/or pressure? Will the small particles of bone in the center of the transplanted mass remain viable long enough for a blood supply to be derived from the peripheral recipient bed?

In regard to the first question, we consulted Dr Russell Meyers, of the Division of Neurosurgery, University Hospital, who felt that no damage to the brain would result from such a procedure, especially if the graft could be laid on top of the greatly thickened dura that results from a healed inflammatory process

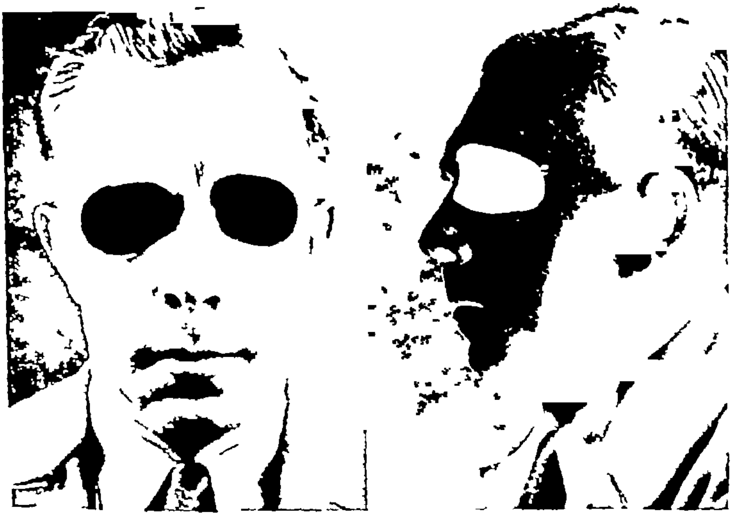


Fig 1

In answer to the second question, Dr Arthur Steindler, of the Department of Orthopedic Surgery, assured us that we need have little fear of losing the deep particles of the graft because of inadequate blood supply He not only felt that adequate nutrition would be obtained, but was convinced that

all the tiny fragments of bone would be solidified into one solid mass within a few weeks

These encouraging and authoritative answers to our most obvious problems led us to attempt the obliteration of large frontal bone defects with bits of cancellous bone cut as small as possible We were amazed at the ease with which reconstruction could be carried out, and at the satisfactory results obtain from such a relatively simple procedure

Two illustrative cases are presented

Case 1 G J, No 46 834, a 36 year old white male was first admitted to the University Hospitals on Aug 27 1945, with a diagnosis of acute purulent frontal sinusitis (bilateral), complicated by fulminating acute osteomyelitis of the frontal bone At operation it was necessary to sacrifice both frontal sinuses in addition to the portion of the frontal bone forming the center one-half of the forehead The patient had an uneventful postoperative recovery and was observed for 28 months to make certain that no residual infection was present

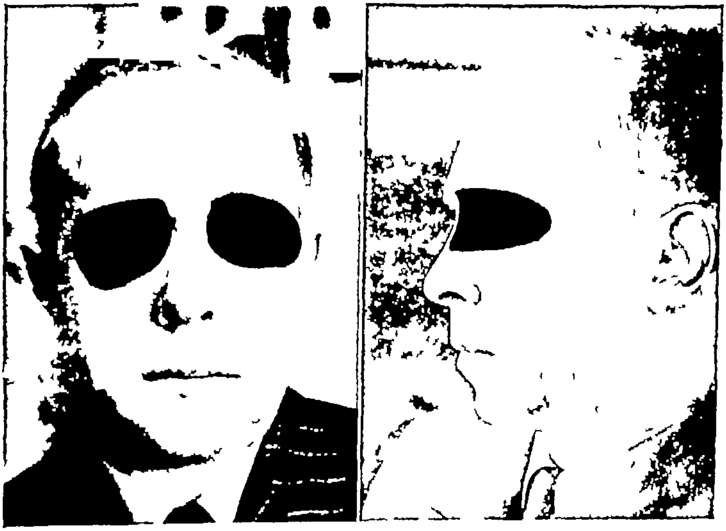


Fig 2

On Dec 9, 1947, the patient was readmitted for obliteration of the frontal bone defect depicted in Fig 1

At operation a large amount of cancellous bone was removed from the posterolateral surface of the ilium The removed bone was then cut into pieces (2 to 4 mm in diameter) as small as possible with heavy suture scissors

A coronal incision in the hair bearing area of the scalp about 4 cm above the edge of the defect in the frontal bone was carried down to the periosteum Through this incision the scalp was separated from the greatly thickened dura in the area of the defect by blunt and sharp dissection elevation was carried subperiosteally over bone about 2 cm beyond the edges of the depression The previously morcellated cancellous bone was introduced into the pocket thus formed By external molding during introduction of the graft the correct contour of the forehead was easily produced

Six weeks after operation the graft was solid to palpation and presented the appearance shown in Fig 2 X ray examination was reported ' showing the previous defect in the frontal bone to be filled with bony tissue it appears that the graft is viable and that healing is in progress'

In the 11 months that have elapsed since operation we have no report of any further changes in the graft.

Case 2 R. M No 44 5460 a summary of this case would be almost a repetition of the first one It is presented only in order to call attention to a variation in operative technique that made the procurement and morcellation of the cancellous bone much simpler

In this instance the anterior one-half of the crest of the ilium was exposed and cancellous bone was obtained from between the inner and outer plates by means of a small curette

DISCUSSION

It is felt that autogenous cancellous bone is the material of choice to be used in the correction of depressed areas of the frontal bone The practice of implanting the bone in minute bits offers a method of shaping the graft to the proper contour without resorting to the extensive soft tissue dissection needed to place correctly a laboriously fashioned graft of large size

REFERENCES

1 O CONNOR, G B *Ann Otol., Rhinol and Laryngol* 47 183 188 1948
2 KAZANJIAN, V H and CONVERSE, J M *Arch Otol* 34 94 112 1940
3 KAZANJIAN V H. and HOLMES, E M *S G and O* 79 397-411, 1944
4 MOWLEM, R *Lancet*, 2 746 748, 1944
5 SCHNITKER, M T and MCCARTHY W D *Surg* 18 94-115 1945
6 GOODALE, R T Ann Otol Rhinol and Laryngol 54 757 762 1945
7 MOWLEM, R Proc Roy Soc Med., 38 171 174, 1945
8 MACOMBER D W *S G and O*, 83 761 766 1946
9 ABBOTT, L C *et al* *Jour Bone and Joint Surg* 29 381-414 1947
10 MARTIN, B C *Surg*, 24 103 108 1948

all the tiny fragments of bone would be solidified into one solid mass within a few weeks

These encouraging and authoritative answers to our most obvious problems led us to attempt the obliteration of large frontal bone defects with bits of cancellous bone cut as small as possible We were amazed at the ease with which reconstruction could be carried out, and at the satisfactory results obtain from such a relatively simple procedure

Two illustrative cases are presented

Case 1 G J, No 45 834, a 36 year old white male was first admitted to the University Hospitals on Aug 27 1945, with a diagnosis of acute purulent frontal sinusitis (bilateral) complicated by fulminating acute osteomyelitis of the frontal bone At operation it was necessary to sacrifice both frontal sinuses in addition to the portion of the frontal bone forming the center one-half of the forehead The patient had an uneventful post operative recovery and was observed for 28 months to make certain that no residual infection was present

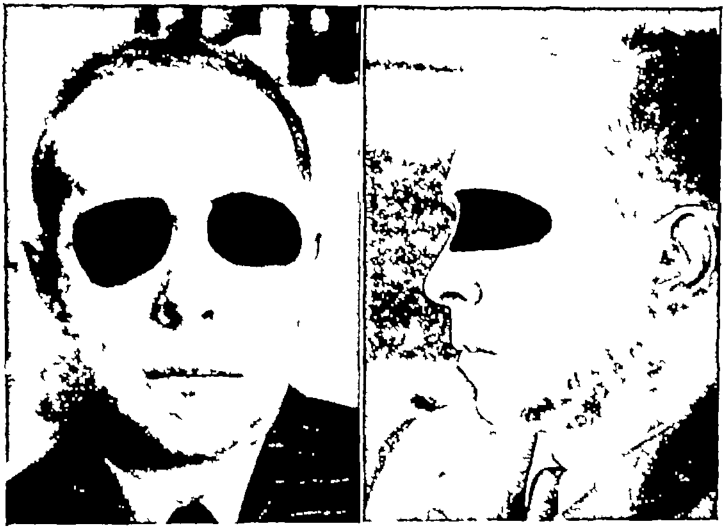


Fig 2

On Dec 9, 1947, the patient was readmitted for obliteration of the pieces (2 to 4 mm. in diameter) as small as possible with heavy suture scissors

A coronal incision in the hair bearing area of the scalp about 4 cm above the edge of the defect in the frontal bone was carried down to the periosteum Through this incision the scalp was separated from the greatly thickened dura in the area of the defect by blunt and sharp dissection elevation was carried subperiosteally over bone about 2 cm beyond the edges of the depression The previously morcellated cancellous bone was introduced into the pocket thus formed By external molding during introduction of the graft the correct contour of the forehead was easily produced

Six weeks after operation the graft was solid to palpation and presented the appearance shown in Fig 2 X ray examination was reported showing the previous defect in the frontal bone to be filled with bony tissue it appears that the graft is viable and that healing is in progress'

In the 11 months that have elapsed since operation we have no report of any further changes in the graft.

Case 2 R. M. No 44-5460, a summary of this case would be almost a repetition of the first one It is presented only in order to call attention to a variation in operative technique that made the procurement and morcellation of the cancellous bone much simpler

In this instance the anterior one-half of the crest of the ilium was exposed and cancellous bone was obtained from between the inner and outer plates by means of a small curette

DISCUSSION

It is felt that autogenous cancellous bone is the material of choice to be used in the correction of depressed areas of the frontal bone The practice of implanting the bone in minute bits offers a method of shaping the graft to the proper contour without resorting to the extensive soft tissue dissection needed to place correctly a laboriously fashioned graft of large size

REFERENCES

1. O Connor, G B *Ann Otol., Rhinol and Laryngol* 47 183-188 1948
2. Kazanjian V H., and Converse, J M *Arch Otol* 34 94-112 1940
3. Kazanjian V H., and Holmes E M. *S G and O* 79 397-411 1944
4. Mowlem, R. *Lancet* 2 746-748 1944
5. Schnitker, M T., and McCarthy W D *Surg.*, 18 94 115 1945
6. Goodale, R T Ann. Otol Rhinol. and Laryngol 54 757-762 1945
7. Mowlem, R Proc Roy Soc Med. 38 171 174 1945
8. Macomber, D W *S G and O.*, 83 761-766 1946
9. Abbott L. C., *et al* *Jour Bone and Joint Surg.*, 29 381-414 1947
10. Martin, B C *Surg.*, 24 103-108 1948

EDEMA OF THE UVULA FOLLOWING DEMEROL-HYOSCINE ANALGESIA.*

V. R. MOORMAN, M.D., and I. M. BIRENBOIM, M.D.,
St. Louis, Mo.

A review of the otolaryngologic literature for the past 10 years has failed to reveal a case report or discussion of edema of the uvula due to hyoscine medication. Although this seems to be a problem encountered primarily by the obstetrical service, where hyoscine or scopolamine is used in a large number of cases for analgesia, in several of the eight cases reported in the obstetrical literature an otolaryngologist was called to assess the cause of acute upper respiratory distress in a patient in active labor.

Kirschbaum[1] first referred to edema of the uvula, in 1942, in a discussion of scopolamine in obstetrics and reported that occasional enlargement of the uvula to five or six times normal size was observed. Steinberg,[2] in 1945, reported four cases of edema of the uvula and glottis as a reaction to demerol-scopolamine analgesia, and one case required tracheotomy as a life-saving measure. The other cases responded to scarification of the uvula and local astringents. Skin tests in his four cases with 1-1,000 gr. of sopolamine intradermally were all positive in varying degrees. In 1948, Jack and Taylor[3] reported in detail one case of edema of the uvula and glottis that required tracheotomy, and three additional cases that responded to lesser measures. Since various other drugs had been combined with scopolamine, it was the consensus of opinion of the authors that scopolamine was the offending drug in all of the cases.

This case of hyoscine sensitivity which caused edema of

---

*From the Department of Otolaryngology, Washington University School of Medicine.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Nov. 20, 1948.

the uvula and respiratory obstruction is reported as an otolaryngologic problem of acute upper respiratory distress encountered on the obstetrical service.

A 31 year-old white primigravida at term entered the obstetrical service of the St. Louis City Hospital on Oct. 11, 1948 in active labor. She was a pre-eclamptic with a history of ankle edema of two months duration, blood pressure of 150/100 and urinary findings of many casts and three-plus albumin. Her prenatal course otherwise had been uneventful. On admission at 11:15 A. M. she received 100 mg. of demoral and 1/150 gr. of hyoscine. Her labor continued periodically through Oct. 11 and 12. Clinically, her toxemia had subsided and was well under control. On Oct. 13 at 10:15 A. M. she received 50 mg. of demorol and 1/150 gr. of hyoscine. At noon the patient developed aphonia and marked respiratory difficulty. An otolaryngology consultation was requested and examination revealed a cyanotic, semistuporous patient having marked inspiratory distress. The otolaryngologic examination was essentially normal except for a large grayish white, tense, polypoid, midline mass which filled the entire pharynx. When the mass was lifted out of the pharynx it was seen to be the uvula which was enlarged approximately 10 times its normal size. The patient was given ephedrine sulphate 3/8 gr. intramuscularly and placed in a Burgess box. Tracheotomy and emergency bronchoscopy sets were placed at the bedside. There was no diminution of size of the uvula after administration of the ephedrine, although the cyanosis decreased somewhat and the respirations were less labored after the patient had been placed in the Burgess box.

Due to the lack of fetal heart beat and the patient's general condition the obstetrical service decided to deliver the patient of the nonviable fetus by forceps. Since pentothal anesthesia was to be administered, it was felt that the danger of laryngospasm could be reduced by topical anesthesia of the pharynx and larynx. This was secured with 2 per cent pontocaine solution topically. During the induction with pentothal the uvula was lifted from the pharynx with a forceps to give a better airway. After surgical anesthesia was reached, stridor was still present, therefore the Jackson laryngoscope was passed and thick mucoid secretions removed from the glottic chink by suction. The interarytenoid mucosa and false cords were somewhat pale and edematous, the true cords, however, appeared to be normal. An airway was inserted and the patient tolerated the forceps delivery and pelvic repair without further respiratory difficulty.

The postoperative course was uneventful; the tracheotomy and bronchoscopy sets were kept at the bedside but were not needed. On the following day the uvula had diminished in size by one-half and on the third postoperative day it appeared to be of normal size but still somewhat reddened.

On Oct. 27 an intradermal skin test with hyoscine was done. The control showed no reaction and the test area showed 4 mm. of erythema. The patient was discharged from the hospital on Oct. 28.

SUMMARY

A summary of the literature of edema of the uvula and glottis following hyoscine (scopolamine) analgesia and the ninth such case to be reported have been presented. The occurrence of edema of the uvula and glottis following hyoscine is infrequent, however, the treatment must be prompt and adequate to control the respiratory embarrassment In the cases reported in the literature this was obtained by tracheotomy, scarification of uvula, or by the application of local astringents In this case the obstruction was relieved by lifting the uvula out of the pharynx, topical anesthesia and the insertion of an airway Tracheotomy and bronchoscopy sets should be immediately available if needed

REFERENCES

1 Kirschbaum, Harry M Scopolamine in Obstetrics *Am Jour Obst and Gynec*, 44 664 672 1942

2 Steinberg, Murray Edema of the Uvula and Edema of the Glottis—A Reaction to Demerol Scopolamine Analgesia *Am Jour Obst and Gynec*, 50 542 545, 1945

3 Jack, Wm W, and Taylor, E Stewart Edema of the Uvula and Glottis Associated with Demerol Scopolamine Analgesia *Am Jour Obst and Gynec*, 56 587 589 1948

CENTRAL ILLINOIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

On Nov 12, 13 and 14, 1948, the Central Illinois Society of Ophthalmology and Otolaryngology held their eleventh meeting at the Abraham Lincoln Hotel in Springfield, Ill Dr F Bruce Fralick, professor of ophthalmology at the University of Michigan, spoke on "Surgical Anatomy of Operations for Glaucoma" and "Diseases of the Tear Duct" Dr F L Lederer, professor and head of the Department of Otoloryngology, University of Illinois, discussed "Modern Approaches to the Prevention and Treatment of Defective Hearing" and "Malignancy in Its Relationship to Nasal Obstruction and Hoarseness" Dr L W Roth, Belleville, Ill, gave a paper on the "O'Connor Cinch Operation," and Dr D K Judd, of Kankakee, Ill, discussed "Malignancies of the Paranasal Sinuses" Thomas W Samuels, an attorney from Decatur, Ill, gave a delightful talk on "A Lawyer Looks at the Medical Profession" The following officers were elected for 1949 President, Dr Clifton S Turner, Peoria, Ill, President-elect, Dr Harold Watkins, Bloomington, Ill, Vice-President, Dr Meredith Ostrom, Rock Island, Ill, Secretary-Treasurer, Dr Philip R McGrath, Peoria, Ill

REPORT OF A CASE OF HERPES LARYNGIS *†

DANIEL B MOFFETT M D , and JAMES J MCFARLAND, M D ,
Washington, D C

Herpes zoster was well known to the ancient clinicians, having been commented upon in the time of Hippocrates To the Greeks it was known as "zoster", the Romans called it "zona" and "cingula," hence the Latin and French word, "chengle," from which is derived our English word, "shingles "[1]

The disease is a virus infection of the posterior root ganglia, and is thought by some to be similar to varicella virus Hunt[2] calls it acute posterior poliomyelitis The specific virus has never been isolated

Herpes laryngis can be classified as rare, Landon[3] states that only 26 cases have been reported in the literature Our review of more recent articles failed to disclose any additional reports Hunt,[4] however, believes that it is more frequent than is commonly supposed There are many diseases involving ulceration and exudation surrounding the mucous membrane of the throat and larynx, which might possibly be confused with herpes laryngis In all cases reported, however, the picture of herpes laryngis was quite definite and unmistakable

Pathologically, it is very similar to anterior poliomyelitis in that round cell infiltration of the posterior root ganglion is found This is followed in many cases by acute hemorrhage into the ganglion, with secondary scar formation and possible permanent damage In the lesions of the mouth and throat the pathology is always unilateral

Each nerve has a characteristic intraoral, pharyngeal and

---

*Case presented before the Staff of the Episcopal Eye Ear and Throat Hospital Washington D C Nov 5 1948

†From the Division of Otolaryngology George Washington University

Editor s Note This ms received in Laryngoscope Office and accepted for publication Dec 1 1948

laryngeal zoster zone We are not concerned here with eruptions of the external skin, except those of the external ear Those involving the mucous membranes of the mouth and pharynx, the external ear and auditory canal have been defined by Hunt[5] as follows

The intraoral, pharyngeal and laryngeal zoster zones of the vagus cover the epiglottis to midline, the arytenoid eminences, the aryepiglottic folds, the pyriform sinus, a wedge-shaped area at the base of the tongue in front of the epiglottis and a portion of the soft palate The Xth cranial nerve produces skin manifestations of a posterior medial strip of the auricle and immediate adjacent mastoid area and the posterior portion of the drum and auditory canal, however, the auricular zoster zone of the Xth cranial nerve cannot be distinguished *from that of the IXth cranial nerve*

The zoster zone of the IXth cranial nerve includes the posterior margin of the soft palate, anterior and posterior tonsillar pillars tonsil and the posterior lateral surface of the base of the tongue

The zoster zone of the VIIth cranial nerve is manifested by facial paralysis and cutaneous eruption of the concha, antihelix and fossa of the antihelix

The zoster zone of the Vth cranial nerve involves the anterior two-thirds of the tongue, plus the labial and gingival mucosa (skin manifestations excluded)

It is interesting to note that, although the vagus nerve supplies the larynx completely, the eruptions of the mucous membrane rarely, if ever, involve the false or true cords

During the first 48 hours of the acute stages of herpes laryngis, there is nothing more than slight inflammation Vesicle formation follows within a short time The vesicles at first contain clear serum, but this soon becomes turbid and is replaced by a brownish-yellow purulent fluid

During the next stage of the disease, the vesicles rupture, leaving shallow ulcers with bright red areolae At first the ulcers are discrete but later they become confluent and are covered with a gray-white membrane which, when removed, often leaves a bleeding surface

Edema of the epiglottis and arytenoid on the involved side, and edema of the uvula, are common findings There is usually cloudy spinal fluid, with lymphocytosis Encephalitis may be a complication of the disease

The aryepiglottic fold, arytenoid cartilage and epiglottis are the sites of predilection The true cords and ventricular bands, as a rule, are not involved except for a slight inflammatory reaction Usually the pyriform sinus and lateral wall of the pharynx remain clear, occasionally the base of the tongue is involved It is rare for the vesicles to appear on the larynx first, and still rarer for the larynx alone to be involved

Recurrences are most uncommon and, since this is true, a careful check of the patient's past medical history is often helpful in making a diagnosis Predisposing factors include colds and influenza, chronic nervous disorders, chronic foci of infection and other virus diseases

The disease process usually terminates in one or two weeks, ending in complete recovery and no permanent sequelae In the beginning of the illness the patient commonly suffers mild chills, moderate fever, general malaise and a burning, scratching sensation in the throat, with severe pain on swallowing With the appearance of the vesicles, the symptoms are intensified Extreme pain in the throat, particularly when swallowing, is the most prominent symptom A slight hoarseness is common After the rupture of the vescles, the symptoms become less severe but may persist for some time

Neural complications may appear singly or in various combinations, depending on the ganglion or ganglia involved Nausea, vomiting, hiccoughing, bradycardia, etc, may appear as a result of the involvement of sundry branches of the vagus nerve These neural symptoms are often transient, disappearing in a few days, on the other hand, they may last a fortnight or longer The virus infection can easily spread from one cranial ganglion to another, and there may be involvement of the ganglion of the Xth, IXth, VIIth or Vth nerves, with or without facial nerve involvement. The resulting facial paralysis may be permanent. Postherpetic signs such as burning sensation, coughing, hiccoughing and neuralgia may last for many months or even years.

There is no specific treatment for herpes zoster. Adequate diet, bed rest and soothing applications are helpful. Injections of snake venom, pituitrin, X-ray, vaccination with blister fluid or smallpox have all been tried with varying degrees of success. Despite the lack of a specific remedy, the prognosis is good. None of the cases reported has been fatal and, as mentioned before, the possibility of recurrence is rare. It should be remembered, however, that all cases of herpes laryngis reported have been unilateral.

CASE REPORT

L. G., white female aged 58 years, was first seen in our office on July 19, 1948. She complained of extreme soreness and tenderness of the left side of the throat, with excruciating pain and burning sensation in the left pharynx, radiating to the left ear. She had some nausea and difficulty in swallowing. Her temperature was 100° F.

The patient's past medical history was not significant. Her family history revealed that a sister had "shingles" in 1936.

Examination showed nothing abnormal other than a very slight hyperemia of the lateral bands of the left pharyngeal wall. The ears were entirely negative. Although she complained of some hoarseness, no pathology of the vocal cords was noted.

Local treatment was ineffectual and she became progressively worse.

On July 21, she was admitted to the hospital. At this time her temperature ranged from 101.5° to 102° F.

On July 22 small blisters appeared on the soft palate and the left lateral pharyngeal wall, posterior to the left tonsillar fossa. Subsequently the blebs ruptured and formed white, shallow ulcers which were covered with necrotic membrane and surrounded by areolae of inflammation. At first they were discrete but later became coalescent and eventually involved the left side of the soft palate, the pharyngeal wall, the epiglottis to the midline and the aryepiglottic fold. They stopped short with a sharp line of demarcation just above the level of the false vocal cords. Although she continued to have some hoarseness, the true cords were never involved. There was rather marked edema of the left arytenoid, but no involvement of its mucous membrane, nor was there any limitation of motion.

Throat culture revealed streptococcus viridans and was negative for diphtheria. Urinalysis was negative. Blood analysis showed a hemoglobin of 75 per cent, R. B. C., 4,000,000, W. B. C., 6,100, 79 per cent polymorphonuclears, 20 per cent lymphocytes, N. P. N., 25 mg. per cent.

She was given penicillin 40 000 units of diphtheria antitoxin and intramuscular injections of large doses of thiamin chloride Her nausea and vomiting became more pronounced for which she was given intravenous glucose At this time she developed paroxysms of coughing which continued all the time she was in the hospital

On July 28 after seven days hospitalization she was discharged Her temperature had returned to normal the ulcers and whitish membrane of the pharynx and larynx had disappeared Some referred pain in the left ear persisted and she still complained of inability to swallow food and difficulty in retaining it afterwards

On Aug 5 she was readmitted to the hospital because of a marked increase in the gastrointestinal disturbances She had severe nausea and vomiting with pain in the stomach She could not eat or drink anything except small amounts of barley broth

Her coughing paroxysms continued brought on by what the patient described as something on the back of my tongue She also developed hiccoughs which continued intermittently for two days Each attack of hiccoughing lasted for approximately 30 minutes

On Aug 13 she was again discharged from the hospital her gastric symptoms having subsided The pain in the throat and ear persisted but was much less severe

On Sept. 30 she was seen in the office She now described a feeling as if an electric current were running from the left ear to the larynx a sensation which invariably brought on a paroxysm of strangling and coughing and which occurred about once every hour Rough foods or alcohol aggravated the symptoms We found that we could produce similar attacks by pressing on a trigger zone just behind the posterior tonsillar pillars on the left.

By Oct. 27 some three and one-half months after the onset of the illness the tick disappeared There were still occasional paroxysms of coughing especially at meal time but the other symptoms had subsided She spoke of being bothered by watering of her left eye and by occasional blurring of vision

At the present time the patient appears well All symptoms have disappeared except some paroxysms of coughing at meal time There is no apparent permanent damage as a result of her illness

Of the various medications and treatments prescribed we feel that she derived most benefit from the massive doses of thiamin chloride

SUMMARY

Herpes zoster is a virus infection of the posterior root ganglia Each nerve has a characteristic zoster zone The case of herpes laryngis presented shows a typical pattern of herpes zoster of the left vagus nerve

REFERENCES

1 LEAVITT F H Herpes Zoster of the Cephalic Extremity *Pa Med Jour* 32 9 638 639 June 1929

2 Hunt, J Ramsay Symptom Complex of the Acute Posterior Poliomyelitis of the Geniculate Auditory, Glossopharyngeal and Pneumogastric Ganglia *Arch Internal Med*, 5 6 631 642, June 1910

3 Landon, H R Herpes Laryngis *Arch Otolaryngol*, 10 16 20, 1929

4 Hunt Op cit, p 635

5 *Ibid*, p 633 635

1150 Connecticut Avenue

MISSISSIPPI VALLEY MEDICAL SOCIETY 1949 ESSAY CONTEST

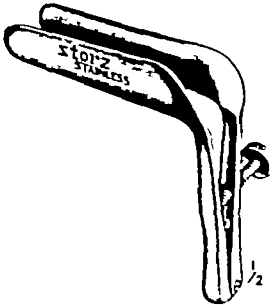
The Ninth Annual Essay Contest of the Mississippi Valley Medical Society will be held in 1949 The Society will offer a cash prize of $100 00, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics and education) and practical value to the general practitioner of medicine Certificates of merit may also be granted to the physicians whose essays are rated second and third best Contestants must be members of the American Medical Association who are residents and citizens of the United States The winner will be invited to present his contribution before the Fourteenth Annual Meeting of the Mississippi Valley Medical Society to be held in St. Louis, Mo , Sept 28, 29, 30, 1949, the Society reserving the exclusive right to first publish the essay in its official publication — the *Mississippi Valley Medical Journal* (incorporating the *Radiologic Review*) All contributions shall be typewritten in English in manuscript form, submitted in five copies, not to exceed 5,000 words, and must be received not later than May 1, 1949 The winning essays in the 1948 contest appear in the January, 1949, issue of the *Mississippi Valley Medical Journal* (Quincy, Ill)

Further details may be secured from Dr Harold Swanberg, Secretary, Mississippi Valley Medical Society, 209-224 W U U Building, Quincy, Ill

A NEW SPECULUM FOR SEPTAL SURGERY *

DANIEL D KLAFF, M D ,
St Louis, Mo

The illustrated instrument was designed to facilitate better visualization of the septum when performing the complete or classical submucous resection The construction is simple and practical



A spring controls the size of the aperture between the blades to facilitate the insertion of the instrument between the mucosal flaps This opening may be diminished by pressing the blades together with the fingers The tension produced by the spring is never great enough to tear the mucosal flaps If further widening of the flaps is desired, it may be obtained by rotating the screw at the side of the shank. When the blades are parallel, the aperture is sufficient to permit a clear view of the septum, thus the instrument is self-retaining There is no tunnelling inward of the blades toward the perpendicular plate of the ethmoid Dorsal and posterior vomerine spurs may be clearly seen The instrument is easily inserted, self-retaining and permits a clear view of the posterior portion of the septum

---

*From the Department of Otolaryngology Washington University School of Medicine

Editor's Note This ms received in Laryngoscope Office and accepted for publication Dec. 14 1948

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

The annual meetings of the Triological Society and the Broncho-Esophagological Association will be held concurrently at the Drake in Chicago on April 18, 19 and 20, 1949 A joint meeting of these two societies will take place Tuesday morning, April 19 On the other days the Triological Society will meet in the mornings and the Bronchoscopic Society in the afternoons

We also call your attention to these dates and places

American Board of Otolaryngology—May 11-14, 1949, New York City

American Laryngological Association—May 16-17, 1949, New York City

American Otological Society—May 18-19, 1949, New York City

In order to facilitate the coordination of national meetings, the Bronchoscopic, the Otological, the Laryngological and the Triological Societies are considering a five-year plan of dates and places By adoption of such a scheme we hope to reduce the traveling mileage and the amount of time away from our offices For additional information, write to Dr C Stewart Nash, Secretary, 708 Medical Arts Building, Rochester 7, N Y

JAN 1 1949

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of January 1, 1949

Acousticon Model A-100
Manufacturer Dictograph Products Corp 580 Fifth Ave New York 19 N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H
Manufacturer Aurex Corp, 1117 N Franklin St. Chicago Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac
Manufacturer Beltone Hearing Aid Co 1450 W 19th St Chicago Ill

Dysonic Model 1
Manufacturer Dynamic Hearing Aids, 43 Exchange Pl New York 5 N Y

Electroear Model C
Manufacturer American Earphone Co, Inc 10 East 43rd St., New York 17 N Y

Gem Hearing Aid Model V-35
Manufacturer Gem Ear Phone Co Inc 50 W 29th St New York 1 N Y

Maico Type K, Maico Atomeer
Manufacturer Maico Co Inc, North Third St, Minneapolis Minn

1947—Mears Aurophone Model 98, Mears Aurophone Model 200
Manufacturer Mears Radio Hearing Device Corp 1 W 34th St New York N Y

Micronic Model 101 (Magnetic Receiver)
Manufacturer Micronic Co 727 Atlantic Ave Boston 11 Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic
Manufacturer Microtone Co 4602 Nicollet Ave Minneapolis 9 Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories, 815 S Hill St, Los Angeles 11, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2

Manufacturer Otarion Hearing Aids, 159 N Dearborn St, Chicago, Ill

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS

Manufacturer Paraphone Hearing Aid, Inc, 2056 E 4th St, Cleveland, Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale, Chicago 11, Ill

Radioear Masterpiece, Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone

Manufacturer E A Myers & Sons, 306 Beverly Rd, Mt Lebanon, Pittsburgh, Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp, 6001 W Dickens Ave, Chicago, Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp, 101 Tremont St, Boston 8, Mass

Solopak Hearing Aids

Manufacturer Allen Howe Electronics Corp, 150 Main St, Peabody, Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900.

Manufacturer Sonotone Corp, Elmsford, N Y

Superfonic Hearing Aid

Manufacturer American Sound Products, Inc, 2151 S Michigan Ave, Chicago, Ill

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex Inc Minneapolis 1 Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc 1627 Pacific Ave Dallas 1 Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm Inc, 400 W Lake St, Libertyville Ill

Unex Model "A"

Manufacturer Nichols & Clark Hathorne Mass

Vactuphone Model 3

Manufacturer Allen Howe Electronics Corp, Salem Mass

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc 120 Broadway New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave Chicago Ill

All of the accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Marvin F Jones, 121 E 60th St, New York 22, N Y
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3, N Y
Meeting New York, N Y, May 18 19, 1949

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Frederick T Hill, Professional Bldg, Waterville, Me
Secretary Louis H Clerf, 1530 Locust St., Philadelphia 2 Pa
Meeting New York, N Y, May 16 17, 1949

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr John J Shea, 1018 Madison Ave, Memphis, Tenn
Secretary Dr C Stewart Nash 708 Medical Arts Building, Rochester N Y
Annual Meeting Chicago, Ill, Hotel Drake, April 18 20, 1949

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St., Charlottesville, Va
Secretary Dr James M Robb, 641 David Whitney Bldg, Detroit, Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens, 35 E 70th St, New York, N Y
President Elect Dr J Mackenzie Brown, 1136 W 6th St Los Angeles, Calif
Executive Secretary Dr William L Benedict Mayo Clinic, Rochester Minn

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley, 384 Post St, San Francisco, Calif
Secretary Treasurer Dr Joseph Hampsey 806 May Bldg, Pittsburgh 22 Pa

AMERICAN BOARD OF OTOLARYNGOLOGY

Meeting New York, N Y May 11 14 1949

PAN AMERICAN ASSOCIATION OF OTO RHINO LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L Jackson, 255 S 17th St., Philadelphia, Pa

Second Pan American Congress of Oto Rhino Laryngology and Broncho Esophagology Montevideo, January, 1950

AMERICAN BRONCHO ESOPHAGOLOGICAL ASSOCIATION

President Dr Paul Holinger, 700 N Michigan Ave, Chicago 11, Ill

Secretary Dr Edwin N Broyles, 1100 N Charles St, Baltimore 1, Md

Meeting Chicago Ill April 18 20 1949

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Colby Hall

Secretary Treasurer Dr Warren A Wilson

Chairman of Section on Ophthalmology Dr John A Bullis

Secretary of Section on Ophthalmology Dr Rodman Irvine

Chairman of Section on Otolaryngology Dr Leland G Hunnicutt

Secretary of Section on Otolaryngology Dr Alden H Miller

Place Los Angeles County Medical Association Bldg 1925 Wilshire Blvd Los Angeles, Calif

Time 6 P M, fourth Monday of each month from September to May inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner 115 E 61st Street, New York 21 N Y

Secretary Dr Norman N Smith 291 Whitney Avenue New Haven 11 Conn

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss 165 Eighth Ave North Nashville 3 Tenn

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg, Atlanta 3 Ga

Vice-Chairman Dr V R Hurst 315 N Center St., Longview, Tex

Secretary Dr Alston Callahan 908 S Twentieth St, Birmingham 5 Ala.

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St, Philadelphia, Pa
Vice President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore, Pa
Treasurer Dr Harry P Schenck, 1912 Spruce St, Philadelphia, Pa
Secretary Dr William J Hitschler, 5 F Chestnut Hill Ave, Philadelphia 18, Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Vicente Banet
Vice-Presidente Dr José Lastra
Secretario Dr René Smith
Vice Secretario Dr Luis Rodriguez Baz
Tesorero Dr Antonio Rodrigues Diaz
Vice Tesorero Dr Tomás Armstrong

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER — CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho, Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice Presidente Dr Luis E Olsen
Secretario Dr Eugenio Romero Diaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez, Dr Nondier Asis R, Dr Jorge Bergallo Yofre

THE
LARYNGOSCOPE.

VOL LIX FEBRUARY, 1949 NO 2

ESOPHAGEAL LESIONS IN DIFFUSE SCLERODERMA *†‡

JOHN R LINDSAY, M D,
Chicago, Ill

The frequency with which esophageal lesions appear in generalized scleroderma was drawn to our attention early in 1943 Six consecutive cases were seen at that time in which a disturbance of esophageal function was demonstrated The symptomatology, Roentgenologic and esophagoscopic findings were reported,[1], and biopsies were made from the lower end of the esophagus in two of the cases

The occurrence of esophageal lesions in this disease was apparently first reported in 1903, but up until the time of writing our report only 16 cases[2-8] were collected by us in the literature, only one of which had undergone an esophagoscopic examination during life

Interest was apparently renewed in scleroderma about that time with the realization that lesions of the viscera were common Two additional reports on involvement of the gastrointestinal tract[9,10] were presented before publication of our report,[1] and shortly thereafter several reports appeared on visceral lesions in scleroderma,[11-17] all of which include reports of esophageal involvement The variety and importance of

---

*From the Division of Otolaryngology of the University of Chicago

†Submitted as Candidate's Thesis to the American Broncho-Esophagological Association November 1947

‡Read before the Midddle Section of the American Laryngological Rhinological and Otological Society Inc. at Iowa City Iowa Jan 17 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication Dec 24 1948

the visceral manifestations of the disease has become generally recognized The disease holds particular interest for the esophagoscopist because of the clinical and esophagoscopic manifestations and because of certain questions connected with their interpretation

Since the former report our observations have been augmented greatly by examination of additional patients and by autopsy studies The gross and microscopic appearance at postmortem examination is of especial value in the interpretation of the clinical, Roentgenologic and esophagoscopic findings

MATERIAL

In addition to the six patients included in the 1943 report, 13 cases of diffuse generalized scleroderma* have since been observed Disturbances of esophageal function have been searched for in 16 of these and the findings briefly listed in Table 1

TABLE 1
ESOPHAGEAL LESIONS IN DIFFUSE GENERALIZED SCLERODERMA

Total number observed since 1942 ..	19
Number with history suggesting pharyngeal or esophageal dys function	13
Roentgen ray examination of esophagus made in	17
Positive Roentgen ray evidence of esophageal dysfunction	15
Dysfunction consisting of Delayed ability of esophagus to cleanse itself of barium, inability to obtain a normal fold pattern and delayed or absent peristalsis	15
Evidence of some degree of stenosis at lower end of esophagus	6
Esophagoscopic examination	11
Apparent stiffening of the esophageal walls plus evidence of inflammatory reaction	11
Leucoplakia, ulceration and some degree of stenosis	5
Gastric type mucosa observed immediately below the stenosed area	4
Ulcerations at lower end of esophagus, proven either by esopha goscopy or at postmortem examination	8

It was pointed out that complaints referable to the esopha-

---

*The term acrosclerosis has not been used in this or in the former report The condition which has sometimes been designated as acrosclerosis is considered to be identical with what always has been called diffuse or generalized scleroderma with sclerodactylia gus, as well as to the involvement of other viscera, are frequently absent because they are obscured in the early stages by the relatively greater severity of the skin and joint manifestations

The fact that in nine other cases of diffuse scleroderma seen previous to 1942 no esophageal symptoms were detected, while in the next 19 cases failure to find definite evidence of esophageal lesions occurred in only one of the completely examined cases is due mainly to a more thorough search having been made in the latter group and also to the stage to which the disease had progressed

The absence of gross esophageal lesions at autopsy in three of the first nine cases observed clinically does not preclude the presence of sclerodermatic changes in the connective tissue and alteration of function of the organ since Roentgenologic and microscopic examinations were not done

Of the 19 cases seen since the beginning of 1943, eight are known to have died, of which seven were autopsied Several others, some of which were in advanced stages, could not be traced

The cause of death in most cases has been the myocardial and the pulmonary lesions

CASE RECORDS

In the former report the esophageal symptoms either volunteered or elicited on questioning were described in five cases The sixth case had symptoms referable to impaired function of pharyngeal musculature Three of the six cases have since come to autopsy No follow-up report has been obtained on the other three in the past three years The 13 cases observed since that report have provided much additional information and the esophageal findings in several selected cases will be described

Case V F Female with onset of symptoms of scleroderma at about 39 years of age. Skin and joint symptoms appeared first.

Dermatologic Diagnosis Diffuse generalized scleroderma Difficulty in swallowing appeared six months after skin symptoms This consisted of regurgitation through the nose and coughing on attempting to swallow fluids Also, food seemed to lodge behind the sternum for some time and occasionally was brought up some time later No pain related to swallowing and no heart burn

Symptoms gradually improved over a period of a year and when examined her symptoms were as follows

Regurgitation of fluids through the nose on swallowing only occasionally

Unable to laugh and cough effectively Difficulty in talking due to loss of air through the glottis Unable to gargle because the liquid runs down the esophagus

Unable to swallow either liquid or solid food while lying down

Examination of pharynx and larynx demonstrated that the glottis did not close adequately on coughing or phonation Inability to laugh or cough effectively and the difficulty on talking were due to inadequate closure of both true and false cords and resultant air loss Movements of the larynx and pharynx were symmetrical

Injection of prostigmine methyl sulfate 1 mg intramuscularly did not produce any change in the glottic function but produced cramps and loss of control of bowels and bladder

Roentgenologic examination by Dr R H Morgan demonstrated spectacular dysfunction of the pharyngeal and esophageal muscles involving both voluntary and involuntary muscles Patient experienced extreme difficulty in causing the constrictor muscles of the pharynx to act and as a result barium flowed up into the nasopharynx and into the larynx when swallowing in the prone position Normal esophageal peristalsis was absent There were no tertiary contractions and no evidence of ulceration in the lower end of the esophagus' The patient was not able to perform a Valsalva test satisfactorily hence the condition of the cricopharyngeus muscle and the presence of a phrenic ampulla could not be determined

Esophagoscopic Examination The cricopharyngeal sphincter appeared to function adequately

There was some difficulty in extending the head due to sclerodermatic changes

The esophageal lining appeared more pink than normal in the middle and lower thirds, but no leucoplakia, exudate or ulceration was evident

Comment Pharyngeal and esophageal dysfunction occurred early in the course of the diffuse scleroderma, the former constituting a major problem

That the symptoms were due to peripheral disease involving muscular function seems confirmed by the absence of central neurologic signs and also the demonstration of sclerodermatic changes in the esophageal walls on microscopic examination in cases examined since that time

Difficulty in swallowing which could be related to pharyngeal dysfunction has occurred in three cases of the group

Case M S Female Onset of symptoms of scleroderma at about age 65 Skin symptoms involving the fingers were followed in three months by difficulty in swallowing Food seemed to stick at times and fail to go all the way down If she attempted to ignore the symptom and continued eating regurgitation of undigested food sometimes occurred Liquids went down without trouble

Dermatologic Diagnosis Diffuse generalized scleroderma

Roentgenologic examination by Dr L Donaldson revealed the following

The esophagus was unable to empty itself of barium even with the patient in the vertical position, although the outlet was adequate

Active peristalsis was practically absent

A persistent narrowing was present a few centimeters above the diaphragm with a lumen reduced to about 1 5 cm, with some dilatation above A good fold pattern could not be obtained in the esophagus above the narrowed region not because of inadequate outlet but apparently because of mixture of fluid and air

A suggestion of a small diverticulum was seen in mid portion

Evidence was obtained on repeated examination that the region between the constriction and the diaphragm represented stomach extending up through the hiatus for a few centimeters The coarse fold pattern characteristic of stomach mucosa was demonstrated in this region, particularly with the patient in the prone-oblique Trendelenburg position

The impression was of a "short esophagus

Esophagoscopic Examination (Dr H B Perlman) Intravenous pentothal anesthesia Little resistance at the cricopharyngeus Mucosa appeared smooth No ulcers or induration were recognized but a biopsy of tissue removed from a whitish area near the lower end of the esophagus proved it to be taken from the edge of an ulcer

Microscopic Examination The surface epithelium of the ulcerated area was replaced by granulation tissue which showed numerous degenerated polymorphonuclear cells on the free surface and infiltration with these and many small round cells The granulation tissue contained many small blood vessels and smooth muscle tissue beneath The remainder of the subepithelial connective tissue was infiltrated with plasma cells and Russell bodies

Comment The esophageal dysfunction was an early manifestation of the diffuse sclerodermatic process in this case

The chief symptom was dysphagia, but the combination of Roentgenologic and esophagoscopic findings demonstrated inability of the esophagus to empty itself even in the upright position, greatly reduced peristalsis, ulceration and beginning stenosis a few centimeters above the diaphragm, and evidence (Roentgenologic) that the stomach extended above the diaphragm The latter occurrence has been usually interpreted as congenitally short esophagus, however, when the incidence of this finding in generalized scleroderma with esophageal regurgitation through the nose and coughing on attempting to swallow fluids Also, food seemed to lodge behind the sternum for some time and occasionally was brought up some time later No pain related to swallowing and no heart burn

Symptoms gradually improved over a period of a year and when examined her symptoms were as follows

Regurgitation of fluids through the nose on swallowing only occasionally

Unable to laugh and cough effectively Difficulty in talking due to loss of air through the glottis Unable to gargle because the liquid runs down the esophagus

Unable to swallow either liquid or solid food while lying down

Examination of pharynx and larynx demonstrated that the glottis did not close adequately on coughing or phonation Inability to laugh or cough effectively and the difficulty on talking were due to inadequate closure of both true and false cords and resultant air loss Movements of the larynx and pharynx were symmetrical

Injection of prostigmine methyl sulfate 1 mg intramuscularly did not produce any change in the glottic function but produced cramps and loss of control of bowels and bladder

Roentgenologic examination by Dr R H Morgan demonstrated ‘spectacular dysfunction of the pharyngeal and esophageal muscles involving both voluntary and involuntary muscles Patient experienced extreme difficulty in causing the constrictor muscles of the pharynx to act and as a result barium flowed up into the nasopharynx and into the larynx when swallowing in the prone position Normal esophageal peristalsis was absent There were no tertiary contractions and no evidence of ulceration in the lower end of the esophagus The patient was not able to perform a Valsalva test satisfactorily, hence the condition of the cricopharyngeus muscle and the presence of a phrenic ampulla could not be determined

Esophagoscopic Examination The cricopharyngeal sphincter appeared to function adequately

There was some difficulty in extending the head due to sclerodermatic changes

The esophageal lining appeared more pink than normal in the middle and lower thirds but no leucoplakia exudate or ulceration was evident

Comment Pharyngeal and esophageal dysfunction occurred early in the course of the diffuse scleroderma, the former constituting a major problem

That the symptoms were due to peripheral disease involving muscular function seems confirmed by the absence of central neurologic signs and also the demonstration of sclerodermatic changes in the esophageal walls on microscopic examination in cases examined since that time

Difficulty in swallowing which could be related to pharyngeal dysfunction has occurred in three cases of the group

Case M S Female Onset of symptoms of scleroderma at about age 65 Skin symptoms involving the fingers were followed in three months by difficulty in swallowing Food seemed to stick at times and fail to go all the way down If she attempted to ignore the symptom and continued eating regurgitation of undigested food sometimes occurred Liquids went down without trouble

Dermatologic Diagnosis Diffuse generalized scleroderma

Roentgenologic examination by Dr L Donaldson revealed the following

The esophagus was unable to empty itself of barium even with the patient in the vertical position although the outlet was adequate

Active peristalsis was practically absent

A persistent narrowing was present a few centimeters above the diaphragm, with a lumen reduced to about 1 5 cm with some dilatation above A good fold pattern could not be obtained in the esophagus above the narrowed region not because of inadequate outlet but apparently because of mixture of fluid and air

A suggestion of a small diverticulum was seen in mid portion

Evidence was obtained on repeated examination that the region between the constriction and the diaphragm represented stomach extending up through the hiatus for a few centimeters The coarse fold pattern characteristic of stomach mucosa was demonstrated in this region particularly with the patient in the prone-oblique Trendelenburg position

The impression was of a short esophagus '

Esophagoscopic Examination (Dr H B Perlman) Intravenous pentothal anesthesia Little resistance at the cricopharyngeus Mucosa appeared smooth No ulcers or induration were recognized but a biopsy of tissue removed from a whitish area near the lower end of the esophagus proved it to be taken from the edge of an ulcer

Microscopic Examination The surface epithelium of the ulcerated area was replaced by granulation tissue which showed numerous degenerated polymorphonuclear cells on the free surface and infiltration with these and many small round cells The granulation tissue contained many small blood vessels and smooth muscle tissue beneath The remainder of the subepithelial connective tissue was infiltrated with plasma cells and Russell bodies

Comment The esophageal dysfunction was an early manifestation of the diffuse sclerodermatic process in this case

The chief symptom was dysphagia, but the combination of Roentgenologic and esophagoscopic findings demonstrated inability of the esophagus to empty itself even in the upright position, greatly reduced peristalsis, ulceration and beginning stenosis a few centimeters above the diaphragm, and evidence (Roentgenologic) that the stomach extended above the diaphragm The latter occurrence has been usually interpreted as congenitally short esophagus, however, when the incidence of this finding in generalized scleroderma with esophageal stenosis is considered, the interpretation of a shortening due to disease appears to be the more probable explanation

Case R S Female with onset of symptoms of scleroderma at about 50 years of age Skin and joint symptoms were predominant from the onset Raynaud like symptoms present

Dermatologic Diagnosis Generalized scleroderma

For about six years patient had experienced pain in her chest from the epigastrium to the neck, coming on mainly after lying down some times also when in the upright position Pain had been relieved partly by various antacid preparations She also had some difficulty in swallowing in that it frequently made her cough Food went down without any feeling of sticking The sensation of pain and heartburn came on afterwards

Roentgenologic examination by Dr L Donaldson demonstrated that barium tended to remain in the esophagus The peristaltic wave was present, although weaker than normal The fold pattern was obtained with difficulty

No evidence of ulceration or constriction was observed

Esophagoscopic Findings Intravenous pentothal anesthesia The upper third of the esophagus did not appear abnormal In the middle third the color was more pink than normal, and in the lower third, near the lower end patches of leucoplakia were evident with narrow furrows between in which red granulation tissue formed the base There was no definite constriction seen Below this area the mucosa changed abruptly to the gastric type without inflammatory signs The relation of the upper border of gastric mucosa to the level of diaphragm was not definitely determined

Comment The complaint of pain behind the sternum, worse after lying down, has been prominent in at least five of the eight patients known to have ulcerations in the lower third of the esophagus Although the Roentgenologic examination in this case demonstrated rather an early grade of dysfunction, the epithelial lining of the lower third presented evidence of a relatively advanced chronic esophagitis with leucoplakia and superficial ulcerations Shortening of the esophagus was suspected on esophagoscopy but was not proven

Case W S Female with onset of symptoms of scleroderma at about age 62 Raynaud like symptoms predominated for about five years About two months before admission pain in the back between the shoulder blades and shortness of breath began to appear after eating solid foods, which was relieved by regurgitation Symptoms increased and two weeks before admission she had barium studies, esophagoscopy and biopsy of tissue removed from the lower end Low grade malignancy was reported to be the impression Her neck swelled after the esophagoscopy but subsided spontaneously

Dermatologic Diagnosis Generalized scleroderma with Raynaud like symptoms

Roentgenologic examination of esophagus reported by Dr Paul Hodges showed a narrowing of the lower end of the esophagus, involving nearly all of the lower third This was a fusiform narrowing with smooth walls and a dilatation of the middle third above it suggesting stricture rather than neoplasm

Patient coughed on beginning to swallow barium and was seen to have a large unusually shaped diverticulum coming from the posterior wall of the hypopharynx, extending downward as a long rather narrow structure

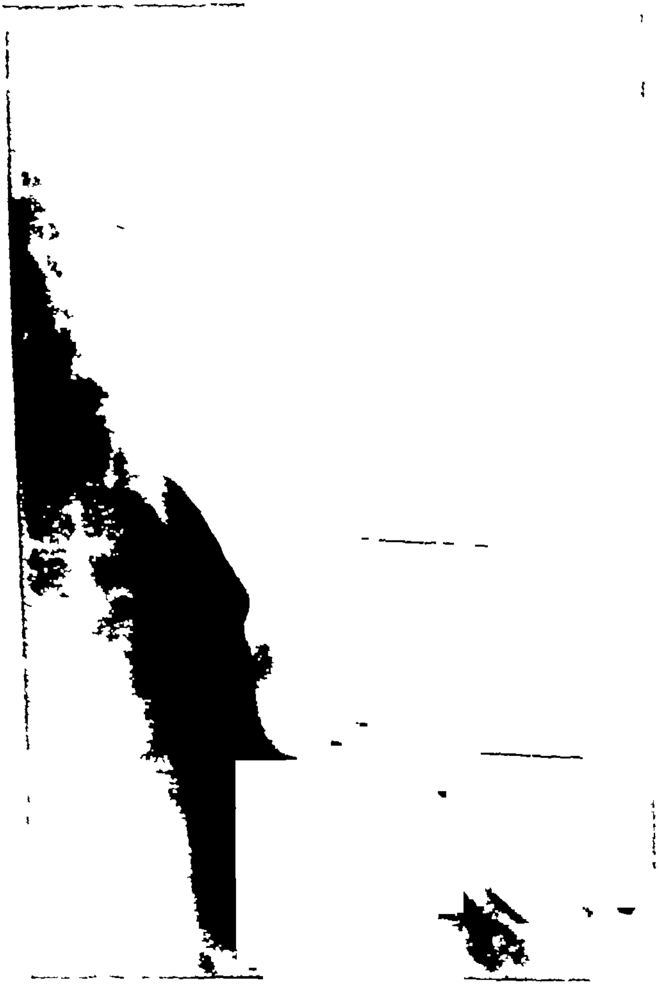


Fig 1. (Case M.S) A persistent narrowing occurred at the lower end of the esophagus (upper arrow) with dilatation above The margins show a fine irregularity in the dilated portion. Barium is not removed. The portion between the constriction and diaphragm (lower arrow) could be made to fill out with patient in the prone oblique Trendelenburg position and demonstrated a coarse fold pattern continuous with that of the stomach mucosa.

stenosis is considered, the interpretation of a shortening du to disease appears to be the more probable explanation

Case R S Female with onset of symptoms of scleroderma at about 5 years of age Skin and joint symptoms were predominant from the onset Raynaud like symptoms present

Dermatologic Diagnosis Generalized scleroderma

For about six years patient had experienced pain in her chest fro the epigastrium to the neck, coming on mainly after lying down, sometimes also when in the upright position Pain had been relieved partl by various antacid preparations She also had some difficulty in swallowing in that it frequently made her cough Food went down without an feeling of sticking The sensation of pain and heartburn came on afterwards

Roentgenologic examination by Dr L Donaldson demonstrated tha barium tended to remain in the esophagus The peristaltic wave wa present although weaker than normal The fold pattern was obtaine with difficulty

No evidence of ulceration or constriction was observed

Esophagoscopic Findings Intravenous pentothal anesthesia The uppe third of the esophagus did not appear abnormal In the middle third th color was more pink than normal and in the lower third near the lowe end patches of leucoplakia were evident with narrow furrows betwee in which red granulation tissue formed the base There was *no definit* constriction seen Below this area the mucosa changed abruptly to th gastric type without inflammatory signs The relation of the upper borde of gastric mucosa to the level of diaphragm was not definitely determine

Comment The complaint of pain behind the sternum, wors after lying down, has been prominent in at least five of th eight patients known to have ulcerations in the lower third o the esophagus Although the Roentgenologic examination i this case demonstrated rather an early grade of dysfunctio the epithelial lining of the lower third presented evidence o a relatively advanced chronic esophagitis with leucoplakia an superficial ulcerations Shortening of the esophagus was suspected on esophagoscopy but was not proven

Case W S Female with onset of symptoms of scleroderma at abou age 62 Raynaud like symptoms predominated for about five years Abou two months before admission pain in the back between the shoulde blades and shortness of breath began to appear after eating solid food which was relieved by regurgitation Symptoms increased and two week before admission she had barium studies, esophagoscopy and biopsy o tissue removed from the lower end Low grade malignancy was reporte to be the impression Her neck swelled after the esophagoscopy but subsided spontaneously

Dermatologic Diagnosis Generalized scleroderma with Raynaud lik symptoms

Roentgenologic examination of esophagus reported by Dr Paul Hodge showed a narrowing of the lower end of the esophagus, involving near all of the lower third This was a fusiform narrowing with smooth walls, and a dilatation of the middle third above it suggesting stricture rather than neoplasm

Patient coughed on beginning to swallow barium and was seen to have a large unusually shaped diverticulum coming from the posterior wall of the hypopharynx, extending downward as a long rather narrow structure

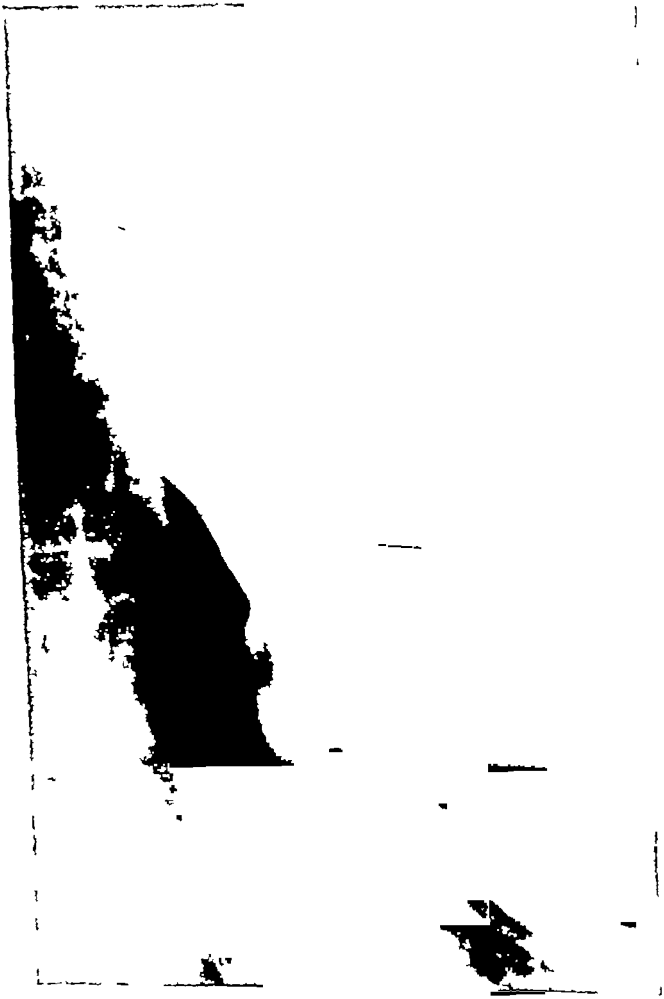


Fig 1 (Case M S) A persistent narrowing occurred at the lower end of the esophagus (upper arrow) with dilatation above The margins show a fine irregularity in the dilated portion Barium is not removed The portion between the constriction and diaphragm (lower arrow) could be made to fill out with patient in the prone oblique Trendelenburg position and demonstrated a coarse fold pattern continuous with that of the stomach mucosa

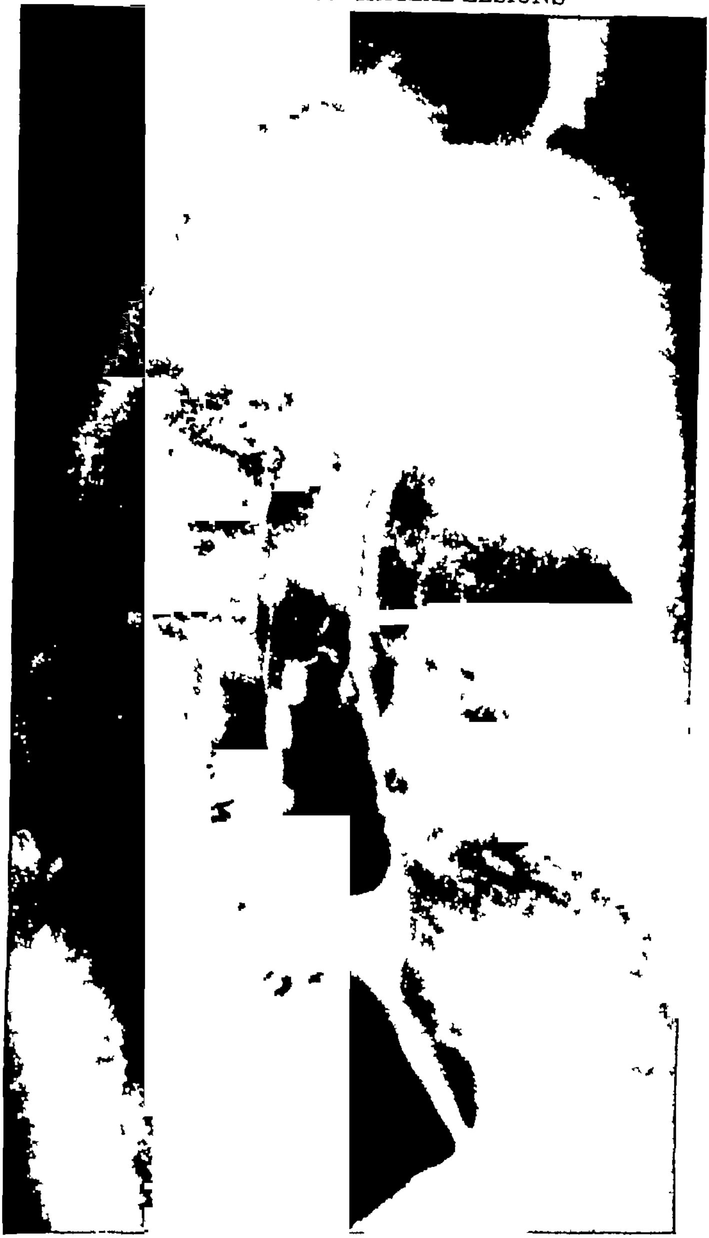


Fig 2 (Case W S) A fusiform narrowing is shown involving most of the lower third of the esophagus with dilatation above The elongated diverticulum-like structure behind the upper third containing barium and air could no longer be seen on X-ray three weeks later Autopsy examination demonstrated a necrotic tract in this region connected with the lumen of the hypopharynx above and the esophagus below

containing barium and air to the junction of upper and middle thirds A possible second small connection with the esophagus was evident near the lower end of the diverticulum (see Fig 2)

Esophagoscopic examination was not made in view of the former biopsy

Fig 3A. (Case W S.) Shows the two openings in the esophageal wall (arrows) The upper just above the pharyngoesophageal junction which were connected by a necrotic tract with fibrosed walls

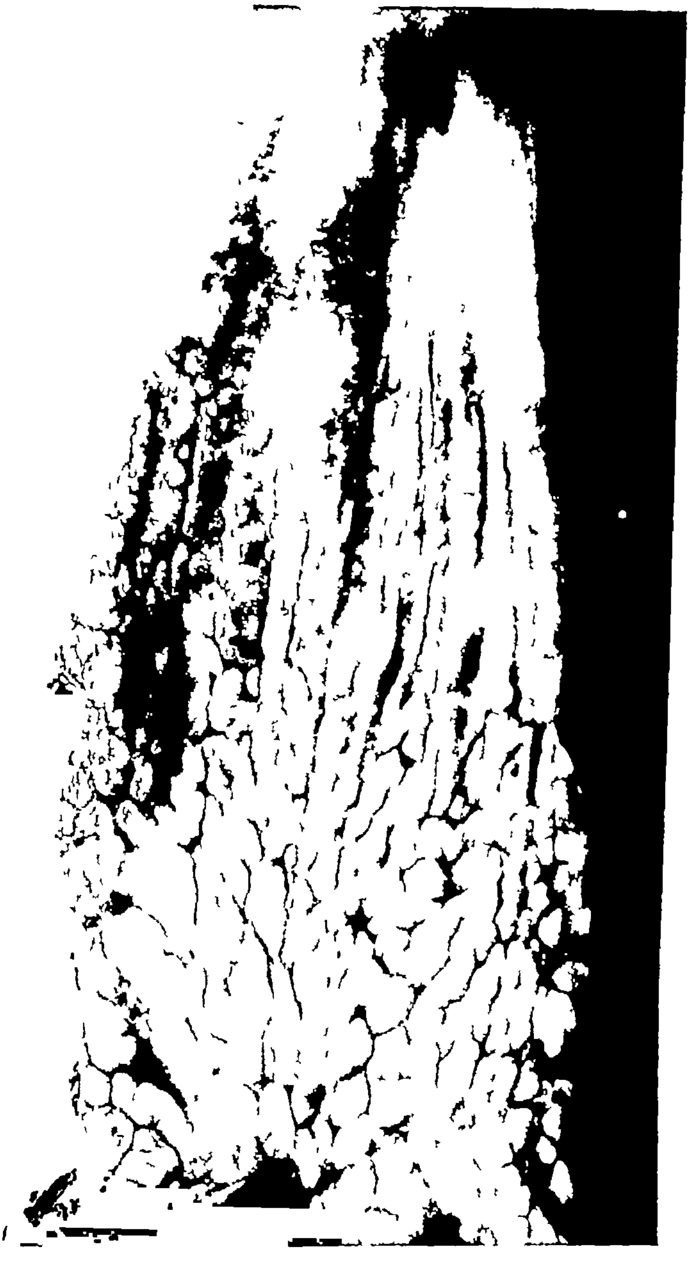


Fig 3B Shows the middle and lower thirds of the esophagus down to the site of the anastomosis Large hyperkeratotic plaques are evident the intervening furrows frequently showing superficial ulcerations

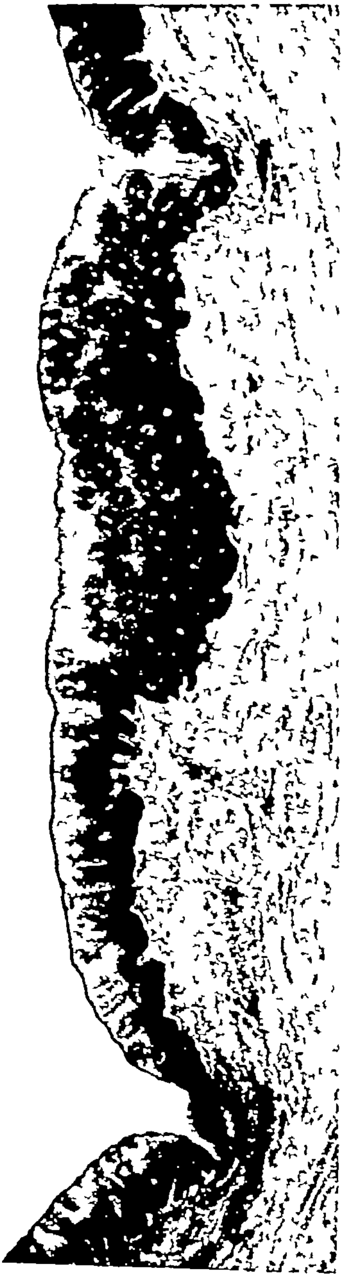


Fig 4A. (Case W S) ×24 Section through hyperkeratotic plaques (leucoplakia) and intervening furrows

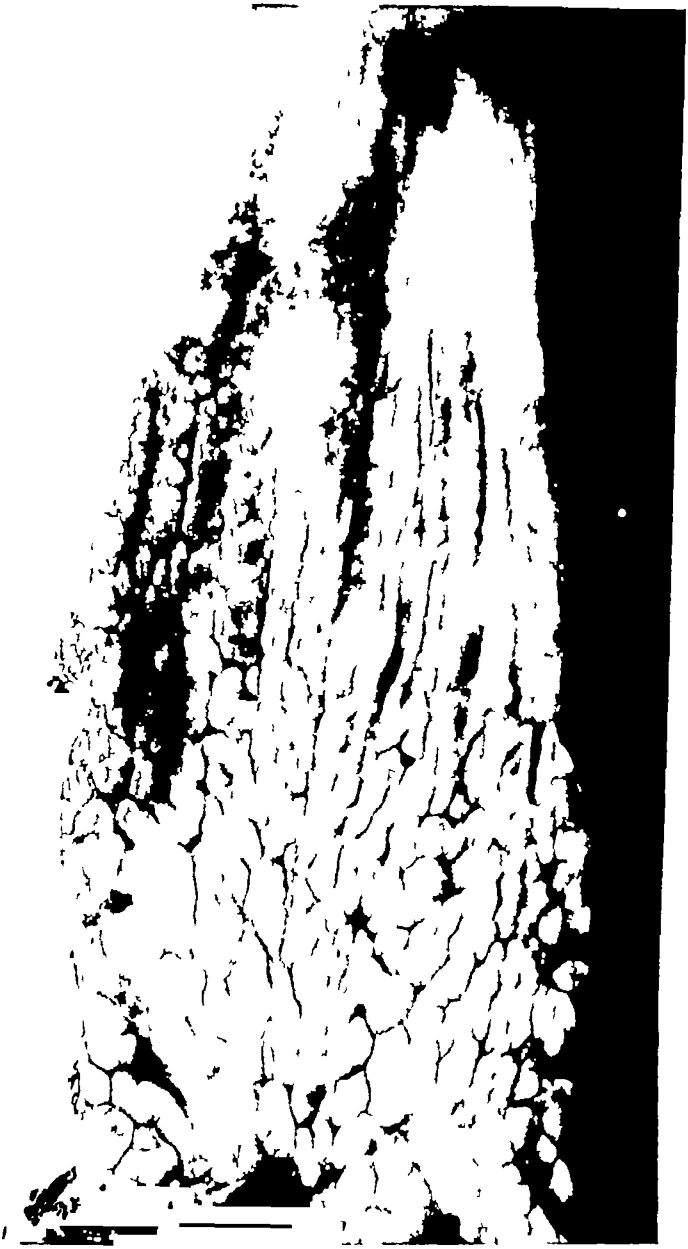


Fig 3B Shows the middle and lower thirds of the esophagus down to the site of the anastomosis Large hyperkeratotic plaques are evident the intervening furrows frequently showing superficial ulcerations

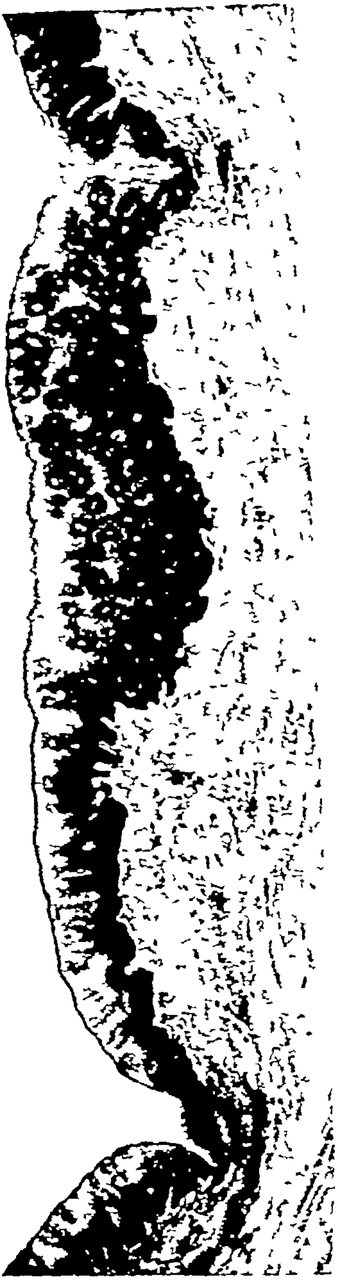


Fig 4A. (Case W S) ×24 Section through hyperkeratotic plaques (leucoplakia) and intervening furrows

One week later, X ray examination did not show any barium rests in the mediastinum At fluoroscopy three and one half weeks after the first examination no evidence of the diverticulum could be found, although thick and thin barium and various postures were used

Transthoracic esophageal gastrostomy with lateral anastomosis was then carried out The surgeon noted that the lower end of the esophagus "was slightly narrow and firm, beginning one inch above the diaphragm

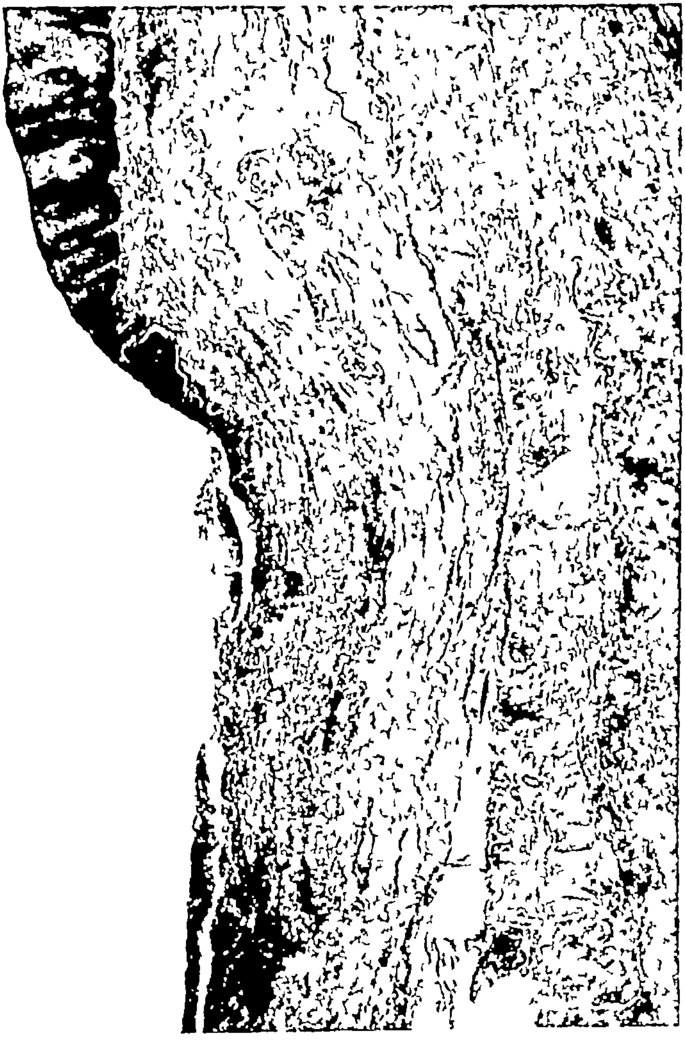


Fig 4B (Case W S) ×26 Upper margin of the diffusely ulcerated and stenosed area in lower third and extending upward two inches No sac like dilatation was noticeable about it.

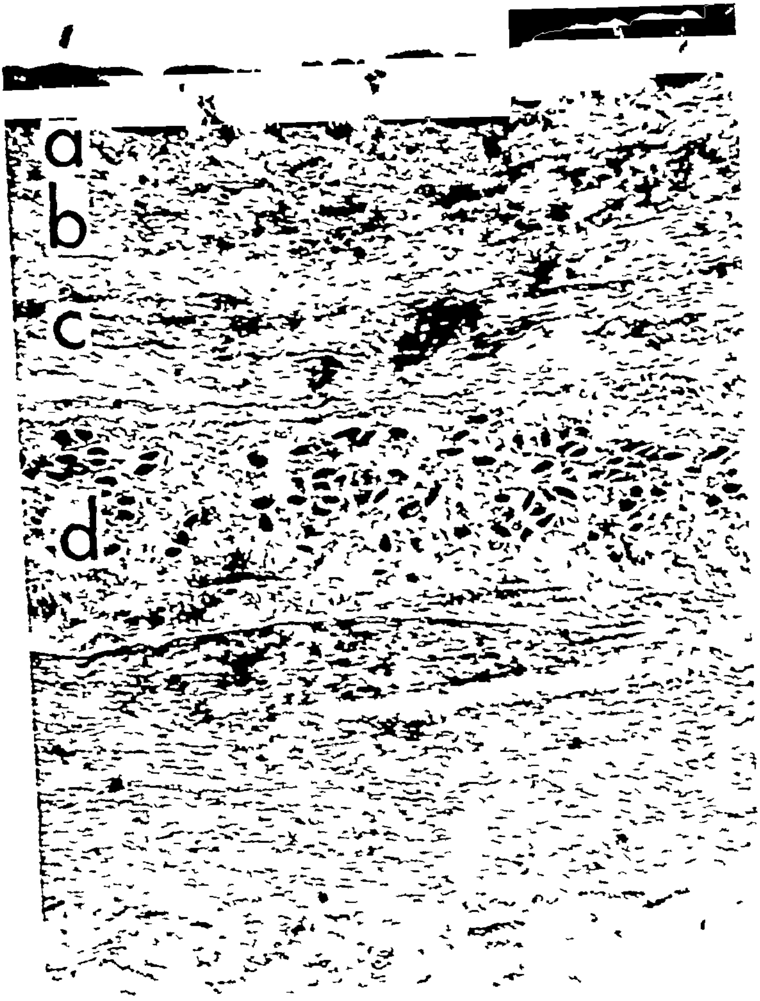


Fig 5 (Case W S) ×70 Section through the upper part of the esophagus The fibrous connective tissue layers (A) beneath the epithelium and (B) between the muscularis mucosa (C) and inner musculature coat (D) show thickening and homogenization of the fibres The inner muscular coat contains some striated muscle as well as smooth muscle at this level Thickening of intervening connective tissue fibres has occurred in this layer widely separating the degenerated muscle fibres

The postoperative course was unfavorable Signs of pneumonia developed, probably due to aspiration Death occurred on fourth day

The postmortem examination showed a rather extensive pneumonia A localized empyema was present at the site of the anastomosis, suggesting that the diseased state of the esophageal wall may have contributed to infection

The complete case history and autopsy report will be published elsewhere in detail The gross and microscopic examination of the esophagus is of particular interest to the endoscopist and is briefly reviewed here

Esophagus — Gross Appearance There was a small pit in the posterior wall at about or just above the junction with the pharynx and a second pit near the junction of upper and middle thirds into which a probe could be easily passed (see Fig 3A)

The middle third presented a diffuse moderate dilatation The epithelium was diffusely hyperkeratotic presenting a patchy appearance The stiffened white patches varied in size up to two thirds of a centimeter and were separated by narrow furrows, the base of which presented bright red granulation tissue (see Fig 3B)

Microscopic Appearance The epithelium in the middle third showed the patches of hyperkeratosis or leucoplakia, between which the epithelium was lost in narrow furrows, with shallow granulation tissue at the base (see Fig 4A)

At the lower end the ulceration was more widespread A thin layer of exudate was present, beneath which was granulation tissue containing some thrombosed vessels hyperplastic capillaries polymorphonuclear cells, and many small round cells and plasma cells in the depths The ulcer extended down into the muscularis mucosa Extensive fibrosis and scarring were present (see Fig 4B)

Immediately below the more or less diffusely ulcerated and scarred area was gastric mucosa in which no inflammatory signs were evident (see Fig 4C)

The subepithelial layers of the esophageal wall presented changes of a striking character This was most evident in the fibrous connective tissue layers beneath the epithelium and beneath the muscularis mucosa Thickening and homogenization of fibrous connective tissue fibres corresponding to that which characterizes the skin in this disease was present Nerve bundles and ganglia were surrounded by these fibres, suggesting the possibility of constriction (see Fig 5)

The inner circular muscle coat where the muscle fibres are mostly cut transversely showed thickening of the intervening connective tissue fibres to the extent that muscle fibres showed all degrees of constriction

The muscularis mucosa showed similar changes to a lesser degree and the outer muscle layer was least affected

The sections of the esophageal wall in the upper part demonstrated a tract extending from the pit in the lower hypopharynx to the second pit about three inches lower down (see Fig 3A) This tract contained no epithelium, the walls consisting of a layer of necrotic tissue surrounded by a granulating and fibrosing area The tract lay in the connective tissue layer, external to the outer muscular coat

Comment This case presented several important features

The history, Roentgenologic and autopsy findings indicated a perforation just above the pharyngoesophageal junction at the esophagoscopy two weeks before admission

Spontaneous recovery occurred, aided probably by spontaneous rupture into the esophagus lower down

History of a similar occurrence following esophagoscopy was obtained from one case (S S) described in our former report Experience has shown that many cases of generalized scleroderma have stiffness of the neck to such an extent that introduction of the esophagoscope under local anesthesia is made extremely difficult and painful By the use of general anesthesia the procedure can be made less trying and more safe

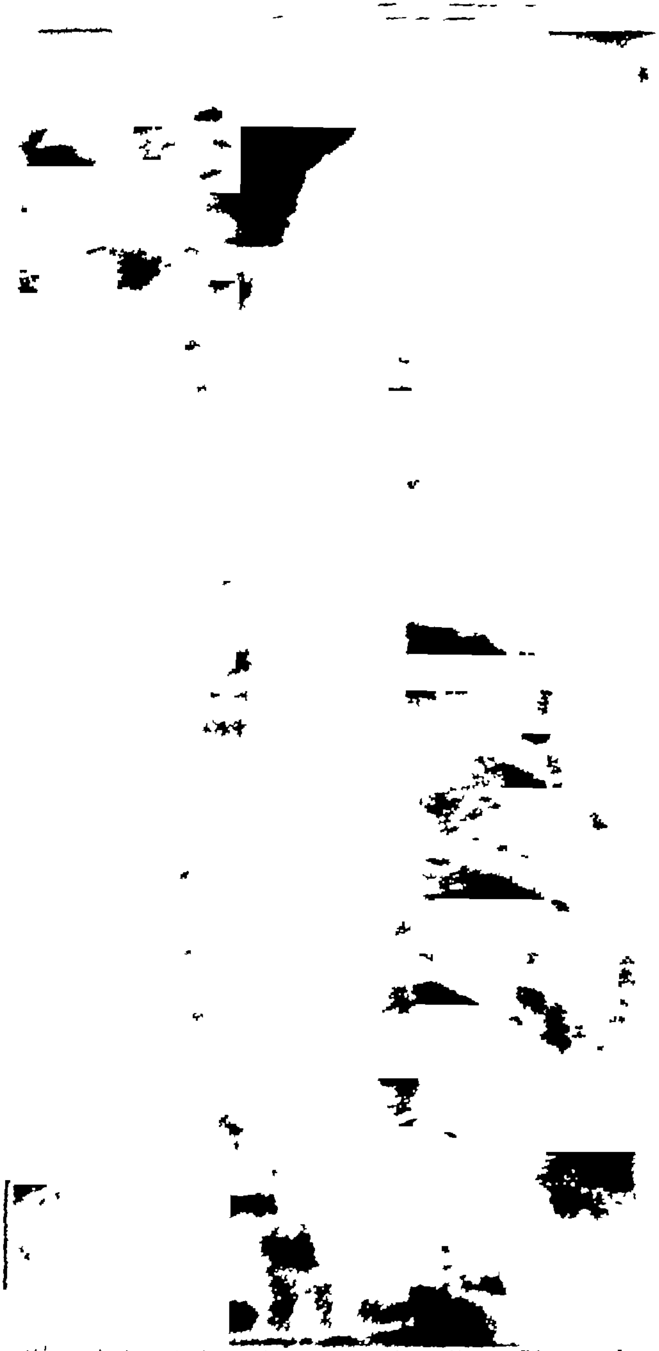
The interference with esophageal function consisting of inability of the organ to clear itself, the loss of normal fold pattern and loss of peristalsis is explained by the effect of the sclerodermatic changes within the walls These changes result in a general stiffening or loss of pliability, interference with muscular action, and possibly involvement of nerves

The impressions repeatedly obtained at esophagoscopy in other cases with similar Roentgenographic findings consisting of a loss of pliability of the walls, a leathery consistency, a color more pink than normal in upper parts and patches of exudate, ulceration and stenosis in lower part were explained by the autopsy examination in this case

The spectacular picture of leucoplakia or hyperkeratotic plaques with intervening ulceration could scarcely be appreciated to the same extent on the limited view obtainable through the esophagoscope

The sections demonstrate the existence of gastric mucosa up to the ulcerated and stenosed lower end of the esophagus According to the surgeon's note the esophagus may have extended only to one inch above the diaphragm at the time of operation, the stomach wall extending up through the hiatus

In addition to the above four cases in which the findings



[illegible] patient in horizontal position The esophagus remains dilated throughout The portion between the stenosis (arrow) and the diaphragm appears to be stomach wall (See Jour A M A 123 745-[illegible]) warranted a detailed description of the esophageal picture, three of the cases included in the former report have since come to autopsy

Case N S (1) with generalized scleroderma. Raynaud like symptoms and advanced esophageal involvement was described in the former report. This patient had suffered from burning pain behind the sternum coming on after meals after lying down and on vomiting and bowel movements for 18 months Roentgenologic findings showed inability of the esophagus to empty retention of air mixed with barium loss of peristalsis and stenosis at the lower end The stenosis was situated a few centimeters above the diaphragm at what was thought to be the upper border of the phrenic ampulla (see Fig 4 of former report) A review of the films in the light of evidence obtained in autopsied cases since that time suggests the interpretation that the stomach extended up through the hiatus and that the esophagus was short The type of folds seen on X ray in the portion below the stricture was suggestive of gastric rather than esophageal mucosa

The esophagoscopic examination as described formerly showed gastric type of mucosa immediately below the stenosed area

Two views (see Figs 5 and 6 of the former report) showed tissue removed from the ulcerated area near the lower end of the esophagus

This patient expired on Oct 2 1944 The autopsy report obtained from the examining pathologist stated that death had occurred from unresolved pneumonia. The esophagus showed a healed esophageal ulcer at the lower end an active ulcer just above that and scarification of the mucous membrane for about two inches above the ulcer

Comment The esophagoscopic findings one and one-half years earlier corresponded to the postmortem description in that ulceration and scarification were present The level of the ulcerated area in relation to the diaphragm was not noted in the autopsy description

A review of the earlier fluoroscopic and esophagoscopic findings strongly suggests that the portion between the stenosis and the diaphragm formerly interpreted as phrenic ampulla consisted of stomach wall extending through the hiatus, and that the esophagus was short

The phrenic ampulla would, therefore, occupy the area of ulceration and stenosis in the lower third and hence fail to show on examination

Case F N described in the former report was again reviewed The fluoroscopic interpretation at that time had been that the dilatation which appeared at the lower end of the esophagus represented phrenic ampulla (see Fig 4 Case 5 of the former report) The esophagoscopic findings were however that the mucosa in the lower end of the lower third of the esophagus showed a thin layer of exudate which when peeled off left a red granulating surface

Below that area the mucosa corresponded in appearance to gastric mucus and was free from inflammatory signs The level of the diaphragm in relation to this area was not determined at esophagoscopy

Review of the Roentgenologic and esophagoscopic findings in this case in the light of information now available indicates that the esophagus was short and that the stomach wall extended up through the hiatus for a few centimeters The phrenic ampulla of the esophagus would not likely be demonstrable in such a case since it would be in the area most affected by the fibrosis following ulceration

Case M G described in the former report expired on May 11, 1947 after the disease had been present for 17 years Raynaud's disease had been the original impression, with indications of generalized scleroderma later becoming evident

At fluoroscopy four years before termination, the slow emptying loss of primary peristaltic movements and inability to form a normal fold pattern had been noted

Esophagoscopic examination at that time demonstrated the loss of pliability of the walls and the slightly pink color of the mucosa, but no leucoplakia and no ulceration or stenosis

Postmortem Examination Cause of death pulmonary and cardiac complications of the generalized scleroderma Esophagus The mucosa appeared grossly normal No ulceration or leucoplakia

Microscopic Examination The epithelium showed no definite abnormalities A section through the wall in the lower end showed pathological changes

The fibrous tissue layers beneath the epithelium and the submucosa showed thickening and homogenization of fibres The inner coat of circular muscle fibres showed thickening of fibrous connective tissue between muscle fibres and great variation in the size of the latter The appearance suggested constriction and degeneration of muscle fibres as a result of the fibrous tissue changes

The muscularis mucosa showed some evidence of the same process, while the outer muscle layer appeared least affected

Comment Although impaired esophageal function was demonstrated four years earlier in this case, there were few symptoms and no inflammatory signs involving the surface epithelium No hyperkeratosis or ulceration occurred

The lack of pain or burning beneath the sternum and the absence of epithelial changes suggest that the cardiac sphincter may have retained its function in this case No definite evidence was obtained that shortening of the esophagus was present

Case J F described in the former report was esophagoscoped repeatedly from 1943 to 1947 for relief of the stenosis which was located about 4 cm above the diaphragm (see Fig 6) The leathery consistency of the esophageal walls noted in the former report was consistently evident

Leucoplakia were observed in the lower third with superficial ulcerations in the lower part between the hyperkeratotic patches More diffuse ulceration was evident at the lower end upon stripping off a layer of exudate with the suction tip

Immediately below the stenosed area the mucosa was dull dark red in

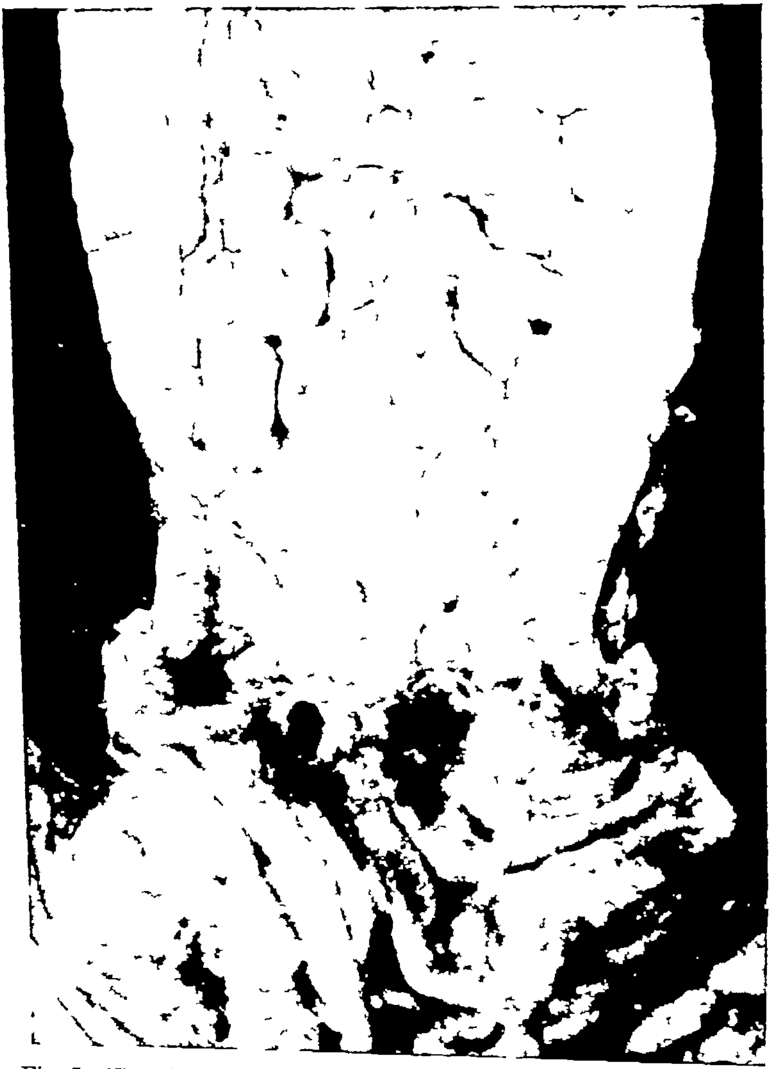


Fig 7 (Case J F) Photograph of the stenosed and ulcerated region at the lower end of the esophagus showing extreme hyperkeratosis above and gastric mucosa below

color corresponding to gastric mucosa in appearance, without evidence of inflammatory changes (see former report)

Death occurred on March 3, 1947 from pulmonary and cardiac compli

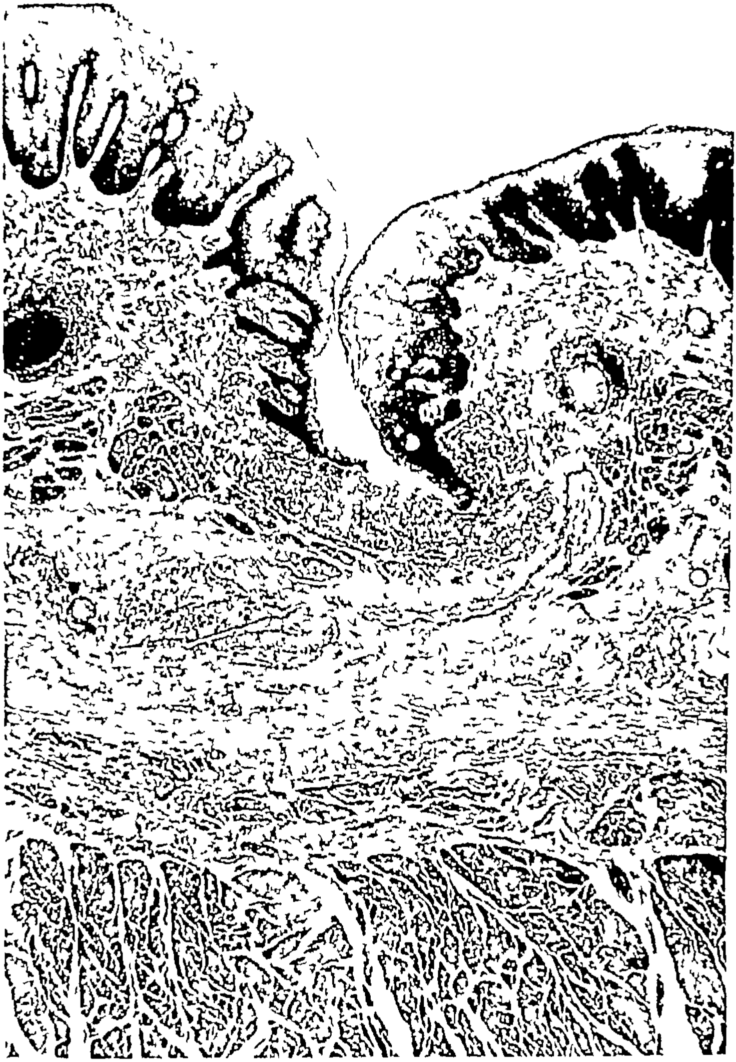


Fig 8 (Case J F) ×60 Lower third of esophagus Superficial ulceration in the furrow between hyperkeratotic plaques The thickening and homogenization of fibrous connective tissue beneath the epithelium beneath the muscularis mucosa and in the inner muscle layer is demonstrated

cations of scleroderma The complete pathologic report will be presented elsewhere

Postmortem Examination of Esophagus The esophagus when removed and opened showed extensive hyperkeratosis or leucoplakia in the form

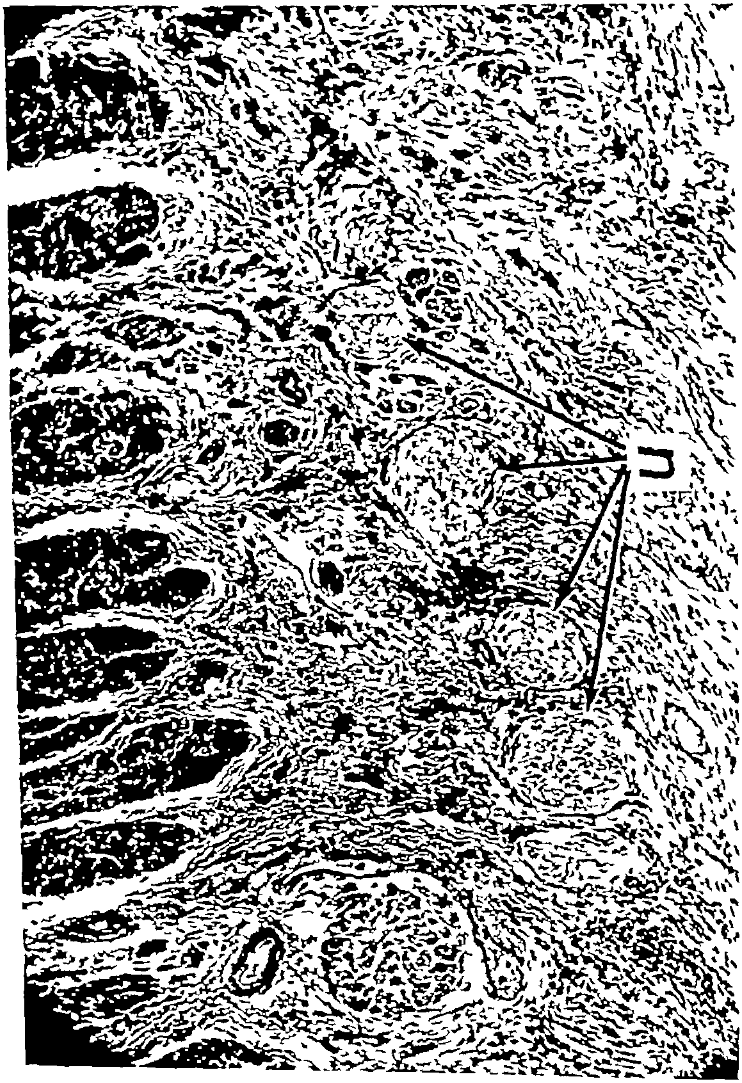


Fig 9 Case J F) ×120 Lower third A row of muscle bundles below and nerves (arrows) above surrounded by thickened connective tissue fibres

of patches, which increased in thickness from the middle third down to the site of the stenosis

In the furrows between the patches of raised epithelium narrow bands

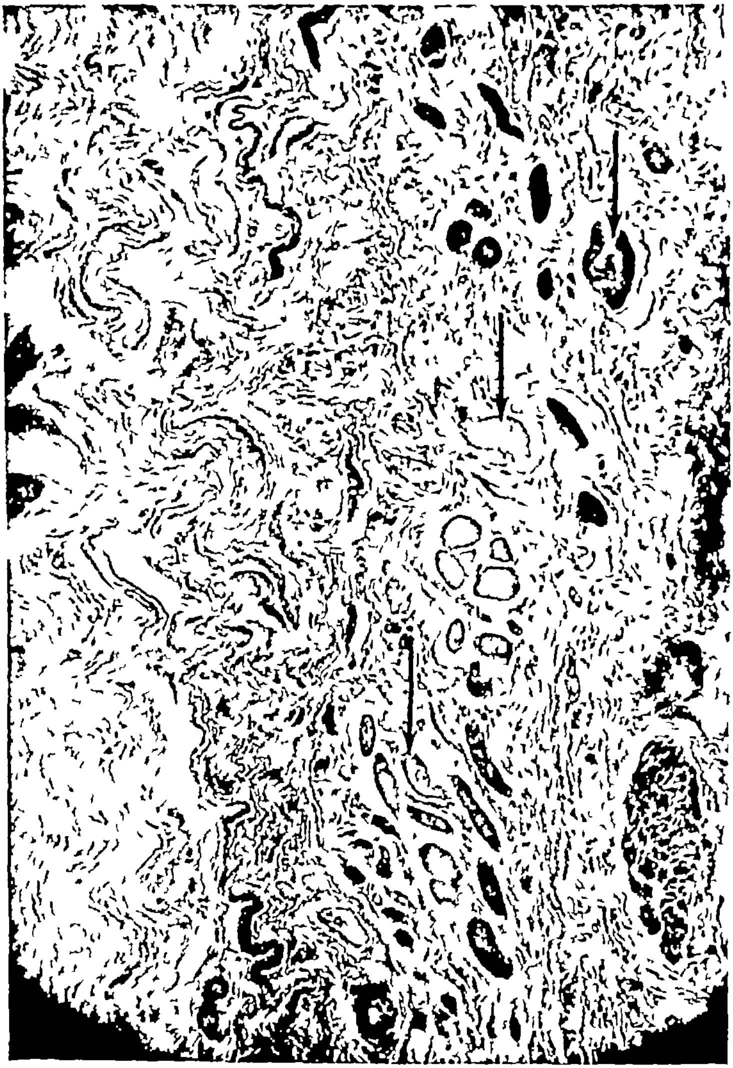


Fig 10 (Case J F) ×120 Upper third Section through the inner muscle layer and part of the outer coat The inner coat consists of sparse smooth muscle cells and both atrophic and swollen degenerating striated muscle fibres (arrows) in a dense collagenic stroma

of red granulation tissue were evident, with occasional larger ulcerated patches at the site of stenosis, covered in places by a layer of exudate

Caudal to the stenosed area the lining consisted of gastric mucosa, thrown into folds without gross evidence of inflammatory reaction The gross appearance of the esophagus is illustrated in Fig 7

Microscopic Examination The epithelium of the lower third of the esophagus showed irregular patches of leucoplakia increasing in thickness towards the lower end, with narrow furrows in the base of which superficial ulceration has occurred (see Fig 8)

Some large ulcers were present at the lower end with more extensive loss of epithelium and of submucosal connective tissue extending down into the muscularis mucosa in some areas There was infiltration by round cells, neutrophilic and eosinophilic polymorphonuclear cells proliferation of fibrous connective tissue and scarring An occasional thrombosed vein was seen in the ulcerated area A thin layer of exudate was present on the surface in some areas Immediately below the stenosed area gastric mucosa was present

The subepithelial layers of the esophagus showed striking pathologic alterations throughout. These were most evident in the fibrous connective tissue layers beneath the epithelium and beneath the muscularis mucosa Thickening and homogenization of the connective tissue fibres was present producing a more dense and broad appearance of these layers (see Fig 8) The same process was evident surrounding nerves and their ganglia (see Fig 9) These changes resembled the findings in the skin which were typical of the disease The layer which showed the next most evident change was the inner muscular coat. In this layer the fibrous tissue between muscle fibres showed the same thickening with varying degrees of degeneration of the muscle fibres The layer consisted mainly of the altered fibrous tissue at the expense of the muscle fibres which were separated and showed varying degrees of reduction in size (see Fig 10) The muscularis mucosa showed the next most evident change, corresponding to the inner circular muscle layer, but to a lesser degree The outer muscle layer showed relatively little alteration

Comment Disturbance of function, consisting mainly of loss of primary peristalsis, delayed emptying, particularly when in the lying position, and moderate stenosis had been evident on Roentgenologic examination four years before death

The exisence of chronic esophagitis, with superficial ulceration near the lower end of the lower third covered by an exudate, scar tissue contraction, and the existence of gastric type of mucosa were recognized on repeated esophagoscopy The esophageal walls had also exhibited a loss of pliability on passing the instrument

The extent and distribution of the surface lesions shown on the gross pathologic examination was more striking, however, than could be realized from the esophagoscopic view

In the previous report the Roentgenologic impression had been that the stenosis occurred above the phrenic ampulla of the esophagus

The autopsy findings demonstrated that gastric mucosa had extended up through the diaphragm for several centimeters to the stenosed area That part of the esophagus which normally forms the phrenic ampulla was, therefore, the site of the ulceration and stenosis and would not be demonstrable on X-ray The interpretation suggested by the pathologic picture was that the esophagus had been shortened by the pathologic fibrous tissue changes within its walls and the stomach pulled up through the hiatus to that extent

The extensive involvement of fibrous connective tissue, and secondarily of muscle fibres, provides an explanation for the disturbance of function Possibly nerve involvement by the same process may also have been a factor (see Fig 9)

The alterations in the epithelial layer probably represent a combination of trophic changes with superimposed surface irritation and inflammation As was previously suggested, the sclerodermatic process may through impairment of muscular function lead to regurgitation of gastric contents which are then inadequately removed, causing pain and tending to produce inflammatory changes, or a diffuse esophagitis The leucoplakia, ulceration and stenosis appear to be best explained as the direct result of a diffuse chronic peptic esophagitis

GENERAL DISCUSSION

A complaint referable to the swallowing mechanism or to the esophagus was volunteered only in those cases with fairly severe symptoms In many cases the severity of the skin and joint symptoms obscured mild difficulties with swallowing

Of the last 19 cases, six gave no history of swallowing difficulties

Five gave a history indicating pharyngeal or glottic dysfunction such as difficulty in starting solid food through the pharynx, coughing on swallowing fluids, inability to close the glottis adequately, or regurgitation through the nose on swallowing liquids

Six gave a history of pain which could be related to the esophagus

Eight cases complained of dysphagia described as inability to swallow in the lying position, a feeling as of food lodging behind the sternum, regurgitation of swallowed food after the meal or inability to get solids down One case already had a gastrostomy when first seen

The varying degrees of pathological findings in the esophagus on Roentgenological examination were as follows

In all cases except two there was failure of the esophagus to clear itself of barium in either the lying or the upright position, retention of air bubbles with barium, fine irregularities along the margins, inability to demonstrate a normal fold pattern, and impairment and eventually absence of primary peristaltic waves

Stenosis was demonstrated to a varying degree in the lower part of lower third with moderate dilatation above in five of the advanced cases and probably present in a sixth The stenosis occurred always a few centimeters above the diaphragm In three of these it was possible to demonstrate a fold pattern extending up to the stenosis which is characteristic of gastric mucosa rather than the finer folds characteristic of the phrenic ampulla of the esophagus Repeated examination was sometimes necessary to bring out the fold pattern

Of the 19 cases seen since 1942, esophagoscopic examination had been done in 11 cases In some, repeated examinations were done for the purpose of observation and dilatation of the stenosed area

All exhibited some degree of abnormality In four this was limited to an alteration in color of the mucosa in the lower part and a loss of normal pliability throughout In addition to these characteristics seven cases showed surface changes in the lower third consisting of exudate and ulceration Leucoplakia was evident in some and stenosis was present in four

When esophagoscopic and autopsy findings are combined there were 14 cases in which the esophagus was inspected directly Eight of these presented ulcerations at the lower end Five of the eight had a definite stenosis, and a sixth a probably early stenosis

A characteristic of the stenosis in these cases was that it occurred always a few centimeters above the diaphragm The esophagoscopic examination demonstrated a fairly abrupt change in the mucosa below the stenosed or ulcerated area to the gastric type, and it was possible in three to obtain Roentgenological evidence that the stomach wall extended up to the stenosis Proof was obtained at autopsy in two that gastric mucosa extended to the lower border of the ulcerated and stenosed area It, therefore, appears to be a characteristic of those cases of diffuse scleroderma with ulceration and stenosis at the lower end of the esophagus that the esophagus is short and the stomach pulled up through the hiatus

The impression of "congenitally short esophagus" and extension of gastric wall a few centimeters above the diaphragm has been reported[12-15] in a number of cases on the basis of Roentgenological examination

Similar cases presented by us formerly[1] were interpreted as having stenosis at the upper border of the phrenic ampulla of the esophagus

Further observations since that time, including esophagoscopic and autopsy findings, have demonstrated beyond doubt that the area between the stenosis and diaphragm consists of stomach wall The interpretation that the short esophagus represents a congenital malformation in such cases does not seem tenable The fact that a shortened esophagus and extension of gastric wall above the diaphragm is so frequent as to be considered a characteristic in generalized scleroderma with ulcerative esophagitis is evidence that the shortening has resulted from fibrous tissue contraction within the walls of the esophagus While the sclerodermatic process may predispose to shortening, the evidence so far indicates that the fibrosis secondary to ulceration may be the chief cause

"Congenitally short esopahgus with thoracic stomach" has been frequently reported in the literature without associated diseases such as scleroderma, and in such cases there has usually been some degree of stenosis at the lower end of the esophagus The explanation has usually been given that ulceration and stenosis result from the irritative action of gastric juice, consequent to the lack of protection afforded by the pinchcock action of the diaphragm

These findings in scleroderma raise the question as to whether the shortening of the esophagus may not have been secondary to a fibrosing lesion in the esophagus in some such cases, rather than a congenital anomaly

Great difficulty is sometimes experienced in obtaining sufficient relaxation to permit introduction of the esophagus in some cases of generalized scleroderma, due in part to tightening of the skin of the neck and face and in part to limitation of movement at joints

Positive evidence was obtained that a perforation of the esophagus had formerly occurred in one case and a history of a probable perforation in another, probably as an indirect result of the difficulty created by the scleroderma Both healed spontaneously

Some type of general anesthesia is, therefore, conducive to greater safety in carrying out the procedure in the presence of diffuse generalized scleroderma

SUMMARY

The disease known as generalized scleroderma is a disease of fibrous connective tissue in which the skin and joints are usually affected first and give rise to the most distressing symptoms

Visceral lesions are also characteristic of the disease and involvement of the lungs, heart, kidneys and gastrointestinal tract is evident in varying degree

Disturbance of the swallowing mechanism, first described in 1903 and reported in a few cases between 1931 and 1937, has become recognized as a common characteristic

In 17 cases observed since 1942, pharyngeal or esophageal involvement was demonstrated by Roentgen examination or esophagoscopic examination, or both, in 15 Two additional cases did not have a special examination of the esophagus

Various stages of pathological disturbance have been demonstrated and the characteristic Roentgenologic and esophagoscopic signs presented

The observations which were presented in a former report consisting basically of Roentgenologic evidence of loss of function, esophagoscopic appearance and biopsies from ulcerated areas have been augmented by gross and microscopic postmortem examinations

Fibrous connective tissue changes, similar to those occurring in the skin, have been shown in the walls of the esophagus

Alteration of function of the esophagus is explainable upon the basis of stiffening, interference with muscular action, and possibly nerve involvement

The surface changes consisting of hyperkeratosis or leucoplakia, ulceration and stenosis appear to require a factor of surface irritation in addition to probable trophic changes for their production since they are not constant

This surface irritation is probably supplied by regurgitated gastric juice from which the esophagus is unable to free itself

The postmortem findings in two cases with stenosis, as well as the accumulated Roentgenologic and esophagoscopic evidence in four additional cases with varying degrees of stenosis, appears to have established the presence of gastric mucosa between the stenosed area and the diaphragm, a distance of 2 to 5 cm

Circumstances appear to indicate that this represents a shortening of the esophagus by disease rather than a congenitally short esophagus

Two factors are present which may contribute to the shortening, the diffuse sclerodermatic process throughout the esophagus and the localized ulceration and fibrosis at the lower end

Dr Eleanor M Humphreys, of the Department of Pathology of the University of Chicago, has aided with the interpretation of pathological material Dr Lillian Donaldson, of the Department of Roentgenology of the University of Chicago, has reviewed the Roentgenological interpretations

BIBLIOGRAPHY

1 Lindsay John R , Templeton Frederic E and Rothman, Stephen Lesions of the Esophagus in Generalized Progressive Scleroderma *Jour A M A*, 123 745 750 Nov 20, 1943

2 Ehrmann, S Ueber die Beziehung der Sklerodermie zu den auto toxischen Erythemen *Wien Med Wchnschr*, 53 1097 1156 1903

3 Schmidt, R Sklerodermie Mit Dysphagie *Deutsche med Wchnschr* , 42 1023, 1916

4 Rake, Geoffrey On the Pathology and Pathogenesis of Sclero derma *Bull Johns Hopkins Hosp*, 48 212, 1931

5 Fessler, A. and Pohl, R Stenotic Process of the Esophagus in Scleroderma *Dermat Ztschr*, 63 164 169 1932

6 Kure, Ken Yamagata, K Tuskada, S and Hiyoshi, J Pasagestörung des Oesophagus bei Sklerodermie und Dystrophia musculorum progressiva *Klin Wchnschr*, 15 516 1936

7 Weissenbach Henry and others Progressive Scleroderma Syn drome of Thibierge-Weissenback Ulcer of the Leg and Calcification of Soft Tissues Esophageal Troubles *Bull Soc franc de dermat et syph.*, 44 2018 2037 1937

Weissenbach, Stewart, and Hoesli, Henry Functional Disturbances of the Esophagus and Esophageal Lesions in Scleroderma *Ibid*, 44 1060 1063 1937

8 Hoesli, Henry Functional Disturbances and Lesions of the Esophagus in Scleroderma Paris Thesis Jouve and Cie, 1937

9 Thomas E W Prosser Calcinosis Cutis and Scleroderma, Thibierge Weissenbach Syndrome *The Lancet*, 2 389-392 Oct. 1942

10 Hale, Clayton H and Schatzki, Richard The Roentgenological Appearance of the Gastrointestinal Tract in Scleroderma. *Am Jour Rentgenol and Rad Ther*, 51 407-420 Apr 1944

11 Jackman, J Roentgen Features of Scleroderma and Acrosclerosis *Radiol*, 40 163 168 1943

12 Goetz, R H Progressive Systemic Sclerosis (Generalized Sclero derma) with Special Reference to Changes in Viscera *Clin Proc (Path)*, 4 337 Aug, 1945

in 1903 and reported in a few cases between 1931 and 1937, has become recognized as a common characteristic

In 17 cases observed since 1942, pharyngeal or esophageal involvement was demonstrated by Roentgen examination or esophagoscopic examination, or both, in 15 Two additional cases did not have a special examination of the esophagus

Various stages of pathological disturbance have been demonstrated and the characteristic Roentgenologic and esophagoscopic signs presented

The observations which were presented in a former report consisting basically of Roentgenologic evidence of loss of function, esophagoscopic appearance and biopsies from ulcerated areas have been augmented by gross and microscopic postmortem examinations

Fibrous connective tissue changes, similar to those occurring in the skin, have been shown in the walls of the esophagus

Alteration of function of the esophagus is explainable upon the basis of stiffening, interference with muscular action, and possibly nerve involvement

The surface changes consisting of hyperkeratosis or leucoplakia, ulceration and stenosis appear to require a factor of surface irritation in addition to probable trophic changes for their production since they are not constant

This surface irritation is probably supplied by regurgitated gastric juice from which the esophagus is unable to free itself

The postmortem findings in two cases with stenosis, as well as the accumulated Roentgenologic and esophagoscopic evidence in four additional cases with varying degrees of stenosis, appears to have established the presence of gastric mucosa between the stenosed area and the diaphragm, a distance of 2 to 5 cm

Circumstances appear to indicate that this represents a shortening of the esophagus by disease rather than a congenitally short esophagus

Two factors are present which may contribute to the shortening, the diffuse sclerodermatic process throughout the esophagus and the localized ulceration and fibrosis at the lower end

Dr Eleanor M Humphreys, of the Department of Pathology of the University of Chicago, has aided with the interpretation of pathological material Dr Lillian Donaldson, of the Department of Roentgenology of the University of Chicago, has reviewed the Roentgenological interpretations

BIBLIOGRAPHY

1 Lindsay John R Templeton Frederic E and Rothman, Stephen Lesions of the Esophagus in Generalized Progressive Scleroderma *Jour A M A*, 123 745 750, Nov 20 1943

2 Ehrmann S Ueber die Beziehung der Sklerodermie zu den autotoxischen Erythemen *Wien Med Wchnschr*, 53 1097 1156 1903

3 Schmidt, R Sklerodermie Mit Dysphagie.*Deutsche med Wchnschr*, 42 1023, 1916

4 Rake, Geoffrey On the Pathology and Pathogenesis of Scleroderma *Bull Johns Hopkins Hosp*, 48 212 1931

5 Fessler, A. and Pohl, R Stenotic Process of the Esophagus in Scleroderma *Dermat Ztschr*, 63 164-169 1932

6 Kure, Ken Yamagata, K Tuskada, S, and Hiyoshi, J Pasagestörung des Oesophagus bei Sklerodermie und Dystrophia musculorum progressiva *Klin Wchnschr*, 15 516 1936

7 Weissenbach Henry and others Progressive Scleroderma Syndrome of Thibierge-Weissenback. Ulcer of the Leg and Calcification of Soft Tissues Esophageal Troubles *Bull Soc franc de dermat et syph*, 44 2018-2037 1937

Weissenbach Stewart, and Hoesli, Henry Functional Disturbances of the Esophagus and Esophageal Lesions in Scleroderma *Ibid*, 44 1060 1063 1937

8 Hoesli, Henry Functional Disturbances and Lesions of the Esophagus in Scleroderma Paris Thesis Jouve and Cie 1937

9 Thomas E W Prosser Calcinosis Cutis and Scleroderma Thibierge-Weissenbach Syndrome *The Lancet*, 2 389 392 Oct 1942

10 Hale, Clayton H and Schatzki Richard The Roentgenological Appearance of the Gastrointestinal Tract in Scleroderma. *Am Jour Rentgenol and Rad Ther*, 51 407-420 Apr 1944

11 Jackman J Roentgen Features of Scleroderma and Acrosclerosis *Radiol*, 40 163 168 1943

12 Goetz, R H Progressive Systemic Sclerosis (Generalized Scleroderma) with Special Reference to Changes in Viscera *Clin Proc (Path)*, 4 337 Aug 1945

13 Olsen, A M O'Leary, P A and Kirklin, B R Esophageal Lesions Asociated with Acrosclerosis and Scleroderma *Arch Int Med*, 76 189, Oct, 1945

14 Pugh D G, Kvale, W F, and Margulies, Harold Scleroderma with Involvement of the Viscera, Report of a Case *Proc Staff Meet Mayo Clin*, 20 410, Oct 31, 1945

15 Rafsky, H A and Herzig, W Scleroderma with Esophageal Symptoms Two Cases *Gastroenterol*, 6 35 30, Jan 1946

16 Richieri, A and D Alotto, V Scleroderma in Patient with Short Esophagus and Thoracic Stomach *Prensa, med Argent* 31 2331 2333, Nov 15, 1944

17 Bevans, M Pathology of Scleroderma with Special Reference to Changes in Gastrointestinal Tract *Am Jour Path*, 21 25, Jan 1945

Footnote Since this paper was completed five additional cases of diffuse generalized scleroderma have been examined In four of these esophageal involvement of varying degrees was demonstrable on X-ray and esophagoscopic examinations

---

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETS AT ST LOUIS, SEPT 28, 29, 30, 1949

The Fourteenth Annual Meeting of the Mississippi Valley Medical Society will be held at the Jefferson Hotel, St Louis, Mo, Sept 28, 29, 30, 1949, under the presidency of Dr Alphonse McMahon, of St Louis University At the recent current meetings of the Society and board of directors, the following officers were elected Dr Nathaniel G Alcock, Iowa City, Iowa, President-elect, Dr Wendell G Scott, St Louis, Mo, First Vice-President, Dr Charles F Harmon, Springfield, Ill, Second Vice-President, Dr John I Marker, Davenport, Iowa, Third Vice-President, Dr Harold Swanberg, Quincy, Ill, Secretary-Treasurer, Dr Ralph McReynolds, Quincy, Ill, Accounting Officer

FURTHER STATISTICAL STUDY OF AUDITORY TESTS IN RELATION TO THE FENESTRATION OPERATION*

W. R. THURLOW, Ph.D.,† H. DAVIS, M.D.,
S. R. SILVERMAN, Ph.D., T. E. WALSH, M.D.,‡
St. Louis, Mo.

In January, 1945, a series of tests of hearing for pure tones and for speech was begun on all patients on whom the fenestration operation was performed by one of us (TEW). Tests were performed before and at various intervals after operation on both the operated and the unoperated ears. Two studies of the inter-relationships of the results of these tests and the Social Adequacy Index for Hearing (SAI) on the first 161 cases have already been published.[10,3] The present report deals primarily with the results on the 55 additional cases operated between Oct. 25, 1946, and Nov. 25, 1947, inclusive. The mean age of the patients in this series was 33.4 years at the time of operation. The standard deviation of the mean (σ) is ±8.1 years, and the range from 17 to 57 years.

I. – PROCEDURE

On Oct. 8, 1946, the testing routine was modified and abbreviated. The new routine was planned particularly *a*. to compare the Threshold of Intelligibility for Connected Discourse with Test No. 9 and with "PB" articulation scores, *b*. to compare pure-tone hearing loss with loss for speech, and *c*. to

---

*This statistical study was carried out under Contract N6onr-272 between the Office of Naval Research and Central Institute for the Deaf.

†Now at Department of Psychology, University of Virginia, Charlottesville, Va.

‡We are indebted to Mrs. J. MacPherson for her careful tabulation of the data and preliminary calculations in preparation for the final statistical tests.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Oct. 29, 1948.

evaluate the results of fenestration by means of the Social Adequacy Index The sequence of tests comprised

1 Pure-tone audiometry by air and bone conduction, performed at McMillan Hospital (Washington University) according to the usual clinical routine,

2 The following monaural, air-conduction speech tests at Central Institute for the Deaf

   a Threshold for Speech by Test No 9 (spondaic words) [6]

   b Threshold of Intelligibility for Connected Discourse (TICD) [5] In this test the subject adjusted the intensity of a recorded newscast until he could just easily follow the sense of the material

   c Articulation score for phonetically balanced monosyllables (PB word lists[4] as recorded at Central Institute for the Deaf), delivered at high intensity The usual level was 110 db re 0 0002 dyne per cm^2, although for some seriously hard-of-hearing ears 120 db was also used and for others, following fenestration, 100 db sufficed If more than one level was used the higher score was taken as the "PB max" The object of the test was to measure the *maximum* articulation score (PB max) that the subject could attain

   d Articulation score (PB lists) at the level of the patient's Threshold of Intelligibility for Connected Discourse

   e From the hearing loss for speech measured by No 9 or TICD or the average of the two, and from the "discrimination loss" (100 – PB max) the Social Adequacy Index was obtained by the tabular method described elsewhere [3]

3 Free Field Tests, binaural, served chiefly for practice before the monaural tests

The usual order of the tests was

1 Free Field No 9, one test, TICD, 3 settings

2 Right Ear No 9, 1 test, TICD, 3 settings

3 Left Ear No 9, 1 test, TICD, 3 settings

4 PB list at high intensity followed by a PB list at the Threshold of Intelligibility for Connected Discourse as determined in the previous tests The same sequence was followed Free Field, Right Ear, Left Ear

The entire testing session lasted about one and one-half hours

The data so obtained allow us to calculate 1) several aspects of the reliability of the various tests as applied to hard-of-hearing ears of young and middle-aged adults, 2) inter-relationships between the several tests, 3) the effects of the fenestration operation (as measured a few weeks to several months following operation) and the significance of changes in operative technique and of the type of bone encountered, 4) several other minor comparisons, such as the relation of the gain from fenestration to clinical diagnosis

II – RELIABILITY

1 *Correlation coefficients and standard errors of measurement*

Descriptions of these statistical measures, with references, have been given in our previous report,[10] and need not be repeated in detail It will be recalled, however, that the standard error of measurement gives the range above and below the true score within which for the average subject a single test may be expected to fall two-thirds of the time on repeated tests

Test-retest reliability was calculated for the *unoperated* ear as the Pearson product-moment correlation coefficient *(r)* between the pre-operative and the first post-operative test The coefficients *(r)* obtained in this way from our data are expressions for the stability of these test measures over a period of time They should thus be distinguished from other expressions for reliability which have been used[1] No allowance is made here for learning effects A value of r above 80 indicates good reliability and a value above 60 is fair

The values of r for the various tests are shown in Table I Some of them, notably for No 9 and the Social Adequacy Index, are very satisfactory and agree well with our previous results For "PB maximum" the reliability is fair, but here a single figure does not tell the whole story As we shall see below, the PB maximum scores are very stable if they are high, *i e*, 85 or better, but vary much more if the original score is below 85

TABLE I
TEST RETEST RELIABILITY AND
STANDARD ERROR OF MEASUREMENT OF AUDITORY TESTS

	Present Series			Previous Series		
	N°	*r*	σm†	N	*r*	σm
Unoperated ear						
No 9	50	87	3 1 db	146	89*	3 9 db
TICD	50	83	3 6			
PB Maximum*	55	61	6 2 %	100	68	10 5 %
SAI	55	87	4 8 %	156	83	6 7 %
Air audiogram (average 512, 1024, 2048, 2896)	55	59	5 9 db			
Gains from Fenestration‡						
No 9	50	79	4 3 db			
TICD	50	71	5 2 db			
Average of No 9 and TICD	50	86	3 4 db			

° N = number of cases
* PB score at 110 or 120 db in present series, at 100 db in first series
† Standard error of measurement
‡ Estimated as explained in text

The standard error of measurement of the hearing loss for the pure tones most important for speech, even for the average *of four tones, is nearly double the standard error of measurement for Test No 9* The test-retest reliability is only fair

For the test-retest reliability of the gains following fenestration it is obviously impossible to get a true test-retest measure The estimates shown in Table I were obtained by assuming that the reliability of the test in the operated ear was similar to that in the unoperated ear Since the reliability is expressed as a correlation coefficient, corrections were made where necessary for a difference in the range of the test scores in the operated ear[8] With these data and the standard deviations and the correlation between pre-operative and post-operative tests on the operated ear we estimated the reliability of the gains by the method of Jackson and Ferguson[illegible] The reliability of the average of No 9 and TICD gains was estimated by using the formula for the reliability of the sum of two scores[illegible]

2 *Drift or Learning*

To detect the presence of drift, such as might occur from learning or practice effects, the means of the scores on three

TABLE II.
DRIFT

Test	N	Drift	Significance
Unoperated ear			
No 9	50	+0 4 db	Not significant at 5% level ("t" test)
TICD	50	+1 0 db	Not significant at 5% level ("t" test)
PB Score at 110* db			
All cases	55	+4 4%	*Significant* at the 1% level ("t" and sign tests)
Scores 85 and over	30	+1 3%	Not significant (sign test)
Scores below 85	25	+8 2%	*Significant* beyond 1% level (sign test)
Operated ear			
PB Score at 110* db	55	+1 7%	Not significant at 5% level ("t" test)

*See Procedure 2c

of the tests on the unoperated ears were calculated for the first and for the second sessions The differences are given in Table II A positive value indicates that the subjects heard better on the second test than on the first It is clear that for Test No 9 and for TICD there is no significant drift Our previous evidence[10] concerning drift for Test No 9 was equivocal

For the unoperated ear the PB articulation score at high intensity (presumably the maximum score that the subject could attain) shows an improvement of 4 per cent on the average The drift is significant in the sense that the probability of a drift of this magnitude occurring by the operation of chance alone is less than one in a hundred The significance of the drift is confirmed by the "sign" test also[10] An improvement of this sort as a result of learning over the first few trials is reasonably to be expected with the PB word lists The direction of the drift is opposite to the drift that we found in the first series[10] We have no explanation for the earlier result, and have more confidence in the present series because the word lists were administered at an average of 110 db instead of 100 db and therefore presumably measure more truly the subject's maximum PB score Furthermore, the standard error of measurement (σm in Table I) for PB score at 110 db is 6 2 per cent in the present series as against 10 5 per cent in the first series

Further light on this situation is shed by breaking down the subjects into two groups, those with high (85 or higher) PB scores at 110 db and those with scores below 85 The group with initially high scores show quite stable PB scores, with an average upward drift of only 1 5 per cent The group with lower initial scores is much more variable and the average upward drift is 8 2 per cent

The "t" test shows that the drift of the PB scores for the unoperated ears as a group is significant at the 1 per cent level of confidence, and this result is confirmed by the "sign" test The same tests show, however, that the slight improvement for the operated ears is not significant at the 5 per cent level of confidence Possibly the operation reduced the discrimination of the operated ears slightly, just enough to offset the learning effect

We conclude tentatively from all of the above information that 1) initially high PB scores at 110 db do not drift significantly and would show a reasonably small standard error of measurement, and 2) initially low PB scores at 110 db would show a considerably larger standard error of measurement The opposite drifts in the two series seem to offset one another although each in itself is statistically significant The levels used in the two series were not identical, however We should expect a slight learning effect, but more data are needed for a final conclusion

III. – INTER-RELATIONS OF TESTS

1 *Speech Tests and Pure-Tone Audiometry*

The correlation was computed between the hearing losses for speech by Test No 9 and the average hearing loss by air for the tones 512, 1024, 2048 and 2896 cps The pre-operative tests for both the unoperated and the operated ears were used, 110 ears in all The coefficient r is ÷ 74 This is exactly the same value that we obtained in the first series

When this coefficient is corrected for the unreliability of the two tests the estimate of correlation becomes 1 00[8 p 203] The two tests apparently measure essentially the same thing although No 9 is a more reliable measure

2 *Test No 9 and TICD*

The correlation between the results of Test No 9 and the Threshold of Intelligibility for Connected Discourse is $r = ÷ 86$ ($N = 110$) This is very nearly as high as the test-retest reliability of Test No 9 itself, and when corrected for the unreliability of each test the estimated correlation becomes 1 00 TICD may therefore be added to Test No 9, Test No 12, and Test 4C as the fourth member of a group of tests of hearing loss for speech that are practically interchangeable with one another The choice between them depends on the reliability of each, and even more on their suitability for a particular patient for psychological reasons or because of his educational background.

The mean difference in absolute threshold (not hearing loss) between Test No. 9 and TICD is 2.4 db for 81 values from unoperated ears and 3.3 db for 81 values from operated ears. In each case the TICD threshold is higher than the threshold for No. 9. The difference of about three decibels is slightly greater than the one decibel reported by Falconer and Davis for normal and for hard-of-hearing ears and is probably a better indication of the difference to be expected when TICD is used in a clinical routine.

We had hoped to improve the accuracy of our measurement of hearing loss for speech by adding TICD to the battery. It now appears, however, because of the higher reliability of Test No. 9, that the advantage is slight. If greater accuracy and assurance are required they are better obtained by giving Test No. 9 twice rather than by giving No. 9 once and TICD once. We therefore in October, 1947, eliminated TICD from our routine for fenestration patients and now rely entirely on Test No. 9.

3. TICD and PB Score

The exact relationship between a test of the threshold for speech and the PB articulation score is of considerable significance as one of us has fully explained elsewhere.[3, 7] If we know the PB score that a subject may be expected to get when given a PB list at the level which we have measured as his threshold by another test then *we may use that other test to locate the position of the foot of his articulation curve more accurately or more rapidly than by giving actual PB lists.*

In the present series the PB articulation score at the Threshold for Intelligibility for Connected Discourse was determined directly on operated and unoperated ears. The mean of 81 values of equivalence for operated ears was 25.6 per cent, for 81 unoperated ears was 24.9 per cent. In other words, at the level at which these patients understood only one quarter of the PB (monosyllabic) words they understood, satisfactorily to themselves, an actual radio newscast This is an important and convenient equivalence to bear in mind

The slope of the lower half of the PB articulation curve, using our apparatus and recordings, is 3 85 per cent per db Applying this relation to the difference in threshold (for the present group of subjects) between TICD and Test No 9 we conclude that for them the PB score at the No 9 threshold is 15 3 per cent correct This value, determined for hard-of-hearing ears, is a little but only a little higher than the value of 8 per cent that we have given as our best overall estimate for normal and for hard-of-hearing listeners combined[3] On the decibel scale the discrepancy amounts to about two decibels

4 *PB Maximum Score and Clinical Grouping*

The cases were grouped by one of us (TEW) on the basis of clinical tests and pure-tone air and bone audiometry, but in ignorance of the results of the speech tests, into three groups conductive (C), conductive-mixed (CM), and mixed-nerve (MN) The basis of the classification is the amount of nerve involvement or perceptive deafness believed to be present The series did not include any cases of pure nerve deafness

TABLE III.

PB MAXIMUM SCORE AND CLINICAL GROUPING

	N	Mean PB score at 110 db
Conductive	34	84 9%
Conductive-mixed	18	78 4%
Mixed-nerve	3	65 3%

Tri-serial eta = 0 54 significant beyond the 1 per cent level

The numbers of cases and the mean PB scores at 110 db for each group are shown in Table III There is a clear relationship to the clinical grouping, and the "tri-serial eta"[10] calculated from these data shows that the relationship could not be expected to occur by chance alone once in a hundred times The tri-serial eta is 0 54 as compared with 0 43 in the previous series

The result is consistent with our generalization that severe high-tone hearing loss, particularly of the perceptive type, causes a discrimination loss, *i e*, a reduction in the patient's maximum PB score

IV – EFFECTS OF FENESTRATION

1 *Gains for Speech and Pure Tones*

In Table IV are given the mean gains for speech and for pure tones that were produced by the fenestration operation

TABLE IV
GAINS IN HEARING FOLLOWING FENESTRATION

Test	N	Mean Gain	Confidence Limit
Speech Tests			
No 9	50	24 3 db	±2 7 db
TICD	50	26 7 db	±2 8 db
Average No 9 and TICD	50	25 5 db	±2 6 db
Air Audiogram			
512	55	23 2 db	
1024	55	24 7 db	
2048	55	21 5 db	
2896	55	9 5 db	
Average	55	19 7 db	
Average of the 50 cases tested by No 9 and TICD	50	19 9 db	±3 2 db

The gains are based on the first post-operative test, usually between three and four months after operation (Our data are still too scanty to make a detailed analysis of the permanence of these gains over longer periods, although we can state broadly that the gains are being retained much better, although not completely now that the cartilage stopple is no longer employed[9])

The figure in the column to the right of the mean gain gives the confidence limits The confidence limits are the limits within which we can expect the true *mean* gain to lie 95 per cent of the time, assuming of course that the selection of cases and operative procedures remain the same

The gains measured by No 9, by TICD and for the first three pure tones are substantial (about 25 db) and quite consistent The "sign" test shows that the differences between the average of No 9 and TICD are not significantly different (even at the 25 per cent level) from the gains for any of the first three pure tones Neither are the differences in gain among these first three tones significant *The only significant differences are those which involve the frequency 2896* either alone or in the average audiogram. Here the gain is significantly less (at the 1 per cent level) than the gain by the average of No 9 and TICD The gain for 2896 is also significantly less than for the frequency 2048 *The relatively small gain at 2896 is obviously responsible for the smaller gain measured by the average air audiogram which we reported for the previous series*[10] *and confirm in Table IV*

We must point out that in a majority of our present cases, due to oversight by our testers, the loss at 2896 was not measured directly in one or both of the tests In these cases the loss at 2896 was interpolated in the audiograms on the basis of the losses measured at 2048 and 4096 and following also the contour of the audiogram for that patient in the tests in which the loss at 2896 was actually measured From inspection of the audiograms it is clear that the gain at 4096 also tends to be less than for the lower frequencies However, the average gains for 2048, 2896, No 9 and TICD have been calculated separately for the 11 cases in which 2896 was directly measured both before and after operation In spite of the small number of cases the "t" test shows that the differences stated above are also significant for this group of cases well beyond the 1 per cent level

It seems that the fenestration operation benefits particularly the lower speech frequencies on which the threshold measurements for speech depend Remember that TICD is a direct test of the intelligibility of connected discourse This is what the patient himself probably uses in his everyday judgment of the benefits of the operation, and the averaged air audiogram, if it includes 2896 or 4096, therefore underestimates the practical gain The practical gain for speech would be quite well estimated from the average gain for the *three* frequencies, 512, 1024 and 2048

We must emphasize again that all of the gains for pure tones and for speech that have been considered in this section are early post-operative gains measured usually about three months after operation The subsequent course of events will be considered in a later report, but inspection of the audiograms indicates that in many cases the hearing for 2896 and 4096 improves significantly between the three-month and the one-year tests The discrepancy between the gain measured by pure-tone audiometry and by speech tests will probably prove to be less for later tests than for the present series of early post-operative tests

2 Relation to Use of Microscope

After the 28th operation in this series the surgeon (TEW) introduced a binocular dissecting microscope as an aid in making the fenestra The operation can be performed more easily and with greater confidence under the dissecting microscope than under the loupe Perhaps the fenestra made under the microscope will prove less likely to close and the clinical records show that the patients suffer less from vertigo immediately after the operation, — but we can see no significant improvement in the immediate gains The mean gain for speech (average of No 9 and TICD) is 26 0 db (N = 28) with the microscope and 25 0 db (N = 21) without it The difference is not significant even at the 5 per cent level, and in any case cannot be differentiated from the possible effects of a general overall improvement in technique or in selection of cases

The gains in Social Adequacy Index with microscope averaged 43 6 db (N = 31), but only 32 4 db (N = 23) without the microscope This difference is significant at the 5 per cent level (η = 29), but in view of the constancy of the gain for speech it obviously depends on the selection of cases with better initial discrimination[3] (Remember that the PB maximum score is not significantly affected by the fenestration operation)

3 Relation to Type of Bone

The type of bone encountered in the operation might have some bearing both on the immediate result and on its permanence The surgeon (TEW) regularly noted whether the bone in each case was brittle (B), hard (H), or soft (S) He also classified the structure of the mastoid bone as sclerotic (Sc), pneumosclerotic (Pn-Sc), or pneumatic (Pn)

No significant differences in the immediate gains from fenestration were found to be associated with either of these two classifications The mean gains, both gain for speech and for improvement in social adequacy index, are given in Table V Tri-serial eta was calculated in each case, but in no case were the differences in the means found significant at the 5 per cent level

TABLE V
RELATION OF IMMEDIATE GAIN (3-4 MONTHS) FROM FENESTRATION TO TYPE OF BONE AND STRUCTURE OF MASTOID

	Gain for Speech Average of No 9 and TICD			Improvement in SAI		
Type	N	Mean Gain	η	N	Mean Gain	η
Brittle	2	14 0 db	29	3	39 0	06
Hard	24	26 1 db		27	38 0	
Soft	14	25 1 db		14	40 5	
Sc	11	26 2 db	07	13	40 1	05
Pn-Sc	12	26 4 db		12	40 0	
Pn	25	25 0 db		28	38 1	

It seems that the fenestration operation benefits particularly the lower speech frequencies on which the threshold measurements for speech depend Remember that TICD is a direct test of the intelligibility of connected discourse This is what the patient himself probably uses in his everyday judgment of the benefits of the operation, and the averaged air audiogram, if it includes 2896 or 4096, therefore underestimates the practical gain The practical gain for speech would be quite well estimated from the average gain for the *three* frequencies, 512, 1024 and 2048

We must emphasize again that all of the gains for pure tones and for speech that have been considered in this section are early post-operative gains measured usually about three months after operation The subsequent course of events will be considered in a later report, but inspection of the audiograms indicates that in many cases the hearing for 2896 and 4096 improves significantly between the three-month and the one-year tests The discrepancy between the gain measured by pure-tone audiometry and by speech tests will probably prove to be less for later tests than for the present series of early post-operative tests

2 Relation to Use of Microscope

After the 28th operation in this series the surgeon (TEW) introduced a binocular dissecting microscope as an aid in making the fenestra The operation can be performed more easily and with greater confidence under the dissecting microscope than under the loupe Perhaps the fenestra made under the microscope will prove less likely to close and the clinical records show that the patients suffer less from vertigo immediately after the operation, — but we can see no significant improvement in the immediate gains The mean gain for speech (average of No 9 and TICD) is 26 0 db ($N = 28$) with the microscope and 25 0 db ($N = 21$) without it The difference is not significant even at the 5 per cent level, and in any case cannot be differentiated from the possible effects of a general overall improvement in technique or in selection of cases

The gains in Social Adequacy Index with microscope averaged 43 6 db (N = 31), but only 32 4 db (N = 23) without the microscope This difference is significant at the 5 per cent level (η = 29), but in view of the constancy of the gain for speech it obviously depends on the selection of cases with better initial discrimination[3] (Remember that the PB maximum score is not significantly affected by the fenestration operation)

3 Relation to Type of Bone

The type of bone encountered in the operation might have some bearing both on the immediate result and on its permanence The surgeon (TEW) regularly noted whether the bone in each case was brittle (B), hard (H), or soft (S) He also classified the structure of the mastoid bone as sclerotic (Sc), pneumosclerotic (Pn-Sc), or pneumatic (Pn)

No significant differences in the immediate gains from fenestration were found to be associated with either of these two classifications The mean gains, both gain for speech and for improvement in social adequacy index, are given in Table V Tri-serial eta was calculated in each case, but in no case were the differences in the means found significant at the 5 per cent level

TABLE V
RELATION OF IMMEDIATE GAIN (3-4 MONTHS) FROM FENESTRATION TO TYPE OF BONE AND STRUCTURE OF MASTOID

	Gain for Speech Average of No 9 and TICD			Improvement in SAI		
Type	N	Mean Gain	η	N	Mean Gain	η
Brittle	2	14 0 db	29	3	39 0	06
Hard	24	26 1 db		27	38 0	
Soft	14	25 1 db		14	40 5	
Sc	11	26 2 db	07	13	40 1	05
Pn-Sc	12	26 4 db		12	40 0	
Pn	25	25 0 db		28	38 1	

Our data on retention of gains for a year or more (on cases operated with a cartilage stopple) are still too meagre to warrant statistical tests of a possible relationship between the type of bone and the tendency of the fenestra to close

V – PREDICTION OF IMMEDIATE GAINS (3-4 MONTHS) FROM CLINICAL DIAGNOSES

Neither the gain for speech (average of No 9 and TICD) nor the improvement in SAI is significantly related to the clinical diagnosis in this series It should be noted, however, that there are only three cases with predominant nerve involvement and no cases that can be classified as "nerve deafness" As a matter of fact, however, the relationship of improvement in SAI is nearly, although not quite, significant at the 5 per cent level The data are shown in Table VI

TABLE VI
RELATION OF IMMEDIATE GAIN (3-4 MONTHS) FROM FENESTRATION TO CLINICAL DIAGNOSIS

		Gain for Speech Average of No 9 and TICD		Improvement in SAI		
Diagnosis	N	Mean Gain	η	N	Mean Gain	η
C	32	26 2 db	17	35	42 7	32
CM	15	26 1 db		17	36 4	
MN	3	20 0 db		3	16 5	

VI – DISCUSSION

The results of the present series of tests confirm, wherever they are comparable, the results of our first series, — with two exceptions Points that are confirmed and which can now be accepted with considerable confidence include

a The test-retest reliability of Test No 9, measuring hearing loss for speech, is high ($r = 87$) For patients who are candidates for the fenestration operation its standard error of measurement is between 3 and 4 db

b With this type of patient the test-retest reliability of the

Social Adequacy Index (for hearing) is about equally high ($r = 87$) Its standard error of measurement is about five points

c Fenestration causes no significant change in the maximum articulation score on the PB test if the test is given at high enough intensity

d The maximum PB score varies with clinical diagnosis It is highest in conductive deafness, slightly lower in conductive deafness with some nerve involvement causing high-tone hearing loss, and still lower if the nerve involvement predominates

e The results of pure-tone audiometry (averaged over the speech range) correlate well with tests of hearing loss for speech such as Test No 9, but such pure-tone audiometry tends to underestimate the gain for speech immediately following fenestration by as much as 5 db

The most important new findings are

a The small and doubtful drift (learning effect) encountered with Test No 9 in the first series is shown not to be significant

b The test of Threshold of Intelligibility for Connected Discourse correlates very highly with Test No 9 Its reliability is almost as high ($r = 83$), its standard error of measurement is a little greater (by about half a decibel), and it shows no evidence of a learning effect Nevertheless, Test No 9 remains our most reliable and generally satisfactory measure of hearing loss for speech

c Pure-tone audiometry (average of 512, 1924, 2048 and 2896) shows a significantly lower reliability ($r = 59$) and larger standard error of measurement (nearly 6 db) than our speech tests

d The underestimate by pure-tone audiometry of the gain (for speech) from fenestration is due to a relatively smaller gain at frequency 2896 The separate frequencies 512, 1024, and 2048 each show nearly the same mean gain for fenestration, and this gain is almost identical with the gain for speech measured by Test No 9 or by Threshold of Intelligibility for Connected Discourse The smaller gain at 2896 is not reflected in the threshold measurements for speech, since this frequency is relatively unimportant for the understanding of easy words (the No 9 list) or for simple everyday connected discourse

e The PB score at high intensity is a quite stable measure if it is initially 85 per cent or higher It is much more variable if it is initially below 85 per cent In the present series there is definite indication of the expected learning effect, particularly for those whose scores are initially low

f The PB score at the intensity level of the Threshold of Intelligibility for Connected Discourse is about 25 per cent in the present series This is a little higher than our previous result for normal listeners and for another group of hard-of-hearing listeners

g The introduction of a dissecting microscope in the operation did not give a greater mean gain for speech The mean gain for the entire series was 25 5 ± 2 6 db

h The gain for speech and the improvement of the social adequacy index are not significantly related to the type of mastoid bone encountered or to the presence of a moderate amount of nerve deafness

SUMMARY

A second series (55 cases of young and middle-aged adults on whom the fenestration operation was performed) was tested (monaurally, both ears) before and a few months after operation by pure-tone air audiometry, by two tests for the threshold of speech (Test No 9 and Threshold of Intelligibility for Connected Discourse) and for maximum articulation score on PB lists given at high intensity (usually 110 db re 0 0002 dyne per cm^2) The Social Adequacy Index (for hearing) was also calculated

Data are given on the test-retest reliability, standard error of measurement and intercorrelations of the various tests, and on the gains following fenestration All of the tests in question show good reliability and all three threshold tests cor-

relate very highly with one another Learning effects were significant only for the PB words at high intensity, and particularly for patients whose initial scores were below 85 per cent

Test No 9 proves to be the most reliable and generally satisfactory test for the threshold of speech for our present type of patient

The Threshold of Intelligibility for Connected Discourse for this series corresponds to the level at which a patient repeats correctly about 25 per cent of the PB words

We have confirmed our previous observation that the gain from fenestration estimated by pure-tone audiometry (average of 512, 1024, 2048 and 2896) is less by about 5 db than the gain measured by speech tests The discrepancy is mainly due to a smaller gain at frequency 2896 as compared with the gains at the lower frequencies

Other details are summarized in the discussion

REFERENCES

1. Cronbach, L J Test "Reliability Its Meaning and Determination. *Psychometrika*, 1947, 12, 1 15

2 Davis, H and Breakey, M Inter-Comparisons of Articulation Tests on Hard-of Hearing and Normal Hearing Subjects (In preparation)

3 Davis, H The Articulation Area and the Social Adequacy Index for Hearing The Laryngoscope, 1948 58 761 778

4 Egan, J Articulation Testing Methods — II The Laryngoscope, 1948 58, 955-991

5 Falconer, G A. and Davis, H The Intelligibility of Connected Discourse as a Test for the 'Threshold for Speech The Laryngoscope, 1947 57 581 595

6 Hudgins, C V , Hawkins, J E , Karlin J E and Stevens S S The Development of Recorded Auditory Tests for Measuring Hearing Loss for Speech The Laryngoscope, 1947, 57, 57 89

7 Jackson, R W B and Ferguson, G A. Studies on the Reliability of Tests *Bulletin No 12, Dept of Educational Research, University of Toronto*

8 Peters and Van Voorhis Statistical Procedures and Their Mathematical Bases New York McGraw Hill Books Inc. 1940

9 Silverman, S R Thurlow, W R Walsh, T E, and Davis, H Improvement in the Social Adequacy of Hearing Following the Fenestration Operation. The Laryngoscope, 1948 58 607 631

10 Thurlow W R Silverman S R. Davis, H, and Walsh, T E A Statistical Study of Auditory Tests in Relation to the Fenestration Operation The Laryngoscope, 1948 58 43 66

REPAIR OF THE SEPTAL PERFORATION
A RHINOLOGIC PROBLEM
A RHINOPLASTIC APPROACH (AUTHOR'S TECHNIQUE)

ROBERT C. SEELEY, M.D.,
New York, N.Y.

In the field of rhinology, one of the most troublesome conditions to be found is the symptom complex of septal perforation. Its importance varies in most cases in direct proportion to the etiological factors producing it.

The medical literature on the subject is notably sparse, particularly with reference to plastic reparative methods directed at closing the perforation. Apropos of this, Imperatori states, "Plastic operations to turn down a flap of mucosa to cover the perforation are done, but in general the results have not been good enough to warrant their being recommended."

With striking parallelism, W. C. Phillips writes, "In cartilaginous perforations, with healed edges, no treatment should be attempted." Similarly, Coates states, "Small perforations are the most annoying to the patient and can always be converted into larger ones when it is inadvisable or impossible to close them."

SYMPTOMS

Patients with cartilaginous perforations usually complain of blockage of the nasal passages because of crust formations which accumulate on the margins of the perforations. This complaint is usually associated with atrophic rhinitis. Repeated hemorrhage is a common finding and is often the result of the individual picking at his nose in an attempt to remove

---

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Feb. 2, 1949.

the crusts Repeated cauterizations to control the bleeding often results in larger perforations Respiratory whistling is another symptom, particularly if the perforation is anteriorly placed and is small

External nasal deformity is a sequela to septal perforation, especially if there has been major destruction or necrosis of the quadrilateral cartilage The deformity is usually a saddle defect of the septal dorsum or bony dorsum, or both In the latter case, the usual cause is syphilis

ETIOLOGICAL FACTORS

There are fundamentally three varieties of septal perforation the most prevalent type is the perforation where the cartilaginous portion alone is involved The second type is the perforation involving the bony portion of the septum The third type is the perforation involving both the bony and cartilaginous portion of the septum The etiological factors, associated with the above three types of septal perforations, may be classified as follows

1 *Metabolic* Those associated with diabetes, syphilis, tuberculosis, cancer, blood dyscrasia, as leucemia, and medical conditions, as diphtheria and typhoid fever, arteriosclerosis with recurring hemorrhages and ulceration, scurvy (with hematoma) Here, perforation is the end-result of a catabolic process This type is often called the spontaneous perforation

2 *Traumatic* (those caused by mechanical manipulation with the finger) Knife wounds, accidental injury with pencils or other implements, prizefighting or acts of felony, crash injuries which result in fracture or dislocation with laceration and perforation of the mucous membrane and perichondrium, with or without infection

3 *Surgical* Perforations resulting from operations to correct the deviation of the septum *per se*, or associated with either radical sinus surgery or other operative procedures, often with the rhinoplastic procedure In small perforations, immediate repair is usually made

4 Chemical Agents These are usually associated with compensation diseases, such as sulphuric acid or chromic acid fumes, mercurial poisons, phosphorus burns, or gases, as phosgene

5 Chronic atrophic sinus disease may also cause septal perforations due to crusting and atrophy of the mucous membrane with exposure of the cartilages and, later, cartilage necrosis, usually associated with secondary infection

6 Postoperative Causes of Septal Perforation Improper packing of the nasal cavity following submucous operations The uneven packing of either plain or vaseline gauze in wads, or circular bundles in the nasal cavity, following submucous resection, in many cases causes undue pressure on the membrane flaps or the nasopalatine (artery) vessels, as a result a postoperative perforation may develop This may not be apparent for a week or two after the surgical procedure, but it usually follows extreme pressure or it may follow the application of sutures or the removal of suture or trauma in pulling the sutures

7 Another cause for perforation is postoperative hematoma or post-traumatic hematoma, inadequately or improperly cared for The mucous membrane and cartilage either break down from circulatory disturbance and pressure or secondary infection with abscess formation

8 Septal abscess, as a result of nasal infection, or as a result of infection postoperative to submucous resection, often results in septal perforation

9 Perforations will result from overzealous cauterization to control epistaxis or spontaneous hemorrhage along the septum with chemical agents, the electrocautery or coagulating and dessicating currents The chemical or thermal process will result in necrosis of tissue

10 Congenital — only a few cases are on record

11 Spontaneous perforations *per se*

PATHOLOGY

Unrelated to any of the above etiological factors, spontaneous perforations of the septum are associated with spur formation, fracture dislocation, or other malformations of the septal cartilage There is an alteration of the air currents in the nasal vestibule which gives rise to the collection of mucus and dust on the mucous membranes The end-result is a drying and irritation of the mucous membrane with the ultimate replacement of the ciliated columnar epithelium with the transitional type The latter is less resistant than the columnar type of epithelium and is subject to cracking with hemorrhage Repetition of hemorrhages follows mechanical manipulation with the fingernail or the violent blowing and twisting of the nose with a handkerchief Following ulceration and perforation of the mucous membrane, the septal cartilage becomes exposed, dries and ulcerates with later perforation The marginal mucous membrane will gradually close over the cartilage edges by fusion

TREATMENT

Medical Treatment This is given with the use of bland ointments locally, such as yellow oxide of mercury, zinc oxide or boric acid, also, topical application of the mild silver nitrate preparation (1 to 5 per cent) to the edges of the perforation after removal of the crusts Exposed cartilage or bone is removed with a forceps Early medical treatment will limit the size of the perforation

When a constitutional disease is associated with the perforation, as in the case of syphilis, diabetes, tuberculosis, typhoid fever and the blood dyscrasias, then the medical treatment is directed to that end

Surgical Treatment It should be the aim of any proposed surgical treatment to restore to the nasal passages the physiologic functional rôle of the septum Early submucous resection will often correct or alleviate the progress of the pathological process in nonconstitutional spontaneous perforation cases Recorded in the literature are four plastic procedures dealing with closure of the septal perforation

1 Goldstein's operation This is a plastic flap operation The free edge of the mucous membrane perforation is pared from the border of the perforation The perichondrium is elevated and a section of intervening cartilage removed A mucous membrane flap is then resected from a contiguous portion of the septum and fitted into the space where the cartilage was resected The flap is held in place by sutures The backing of this flap, as well as the donor site, must close by healing with granulations This invites infection and contraction

2 Chevalier Jackson's procedure is to raise a flap of mucous membrane from the inferior turbinate to close the perforation

3 F J Pratt has proposed the use of a sliding flap of mucous membrane to close the recent perforation or tear

4 McGivern's method is one whereby the free margins of the perforation are freshened and mucosal flaps liberated around the perforation A fitted flap of mucous membrane is cut and sutured to wetproof adhesive which is sutured and held in place for four days with iodoform gauze packing

All the four procedures mentioned above make use of flaps which have mucous membrane on one side and perichondrium or tunica propria on the other The backing of the flap must close by healing with granulation tissue This is equally true of the donor site, for no covering is applied to the area from which the flap is borrowed In consideration of these facts, it is difficult to rule out the possibility of intercurrent infection, as well as contracture of the membrane flap or the membranes proper With such a possibility, the recurrence of the perforation is likely

The scope of this paper is to present a surgical technique in the repair of the cartilaginous septal perforation to offset the disadvantages of previous flap methods of repair The principle underlying the surgical technique proposed is the repair of the perforation by utilization of a double flap repair so that the continuity of the mucous membrane of the septum is restored on each half, right and left, of the septum No donor raw areas are created, and inasmuch as the procedure is accomplished through mobilization of the mucous membrane from the cartilaginous and bony portions of the inner nose, adequate surgical approximation can be made without tension

SURGICAL REPAIR – AUTHOR'S TECHNIQUE

The procedure is best accomplished in the recumbent position The nose is packed as for any rhinoplastic procedure If the case is a postoperative rhinoplasty, then the procedure is planned without an attempt to correct the nasal dorsum unless there is need for secondary correction of the dorsum or tip The approach is entirely through the interperichondrial tissues A marginal incision is made within the naris on each side Through this incision, the mucous membrane is elevated subperichondrially from the lateral alar cartilage and from the inferior side of the upper lateral cartilages This dissection is then carried towards the septal dorsum and the mucous membrane flap is liberated downward away from the dorsoseptal attachment The dissection is further completed as far as the caudal or distal end of the septum circumscribing the perforation area on each side Mobilization of the subperichondrial layer is continued into the region of the perpendicular plate dissecting the mucoperiosteum away from the inferior surface of the nasal bone along the anterior nasal fissure This completely mobilizes the mucous membrane flap on the lateral and medial or septal wall so that the continuous mucous membrane blanket lies free in the nasal cavity This mobilization on the septal side is carried down as far as the vomerine ridge or the upper surface of the hard palate The mobilized flap thus obtained will permit adequate opportunity for direct suture closure of the perforated mucous membrane with silk or catgut after excising the marginal ring of the perforation If necessary, a form of Z-plasty procedure can be adopted to obtain this end This procedure is carried out on each side and then the mobilized flaps are replaced as near as possible in their former position, without undue tension

Suturing of the marginal wound area is then accomplished with interrupted silk sutures or catgut and an intranasal packing of xeroform gauze is lightly packed to maintain the mucous membrane in its anatomical relationship A single layer of gelfoam, approximately one-half inch by one and one-fourth inches in length, can be placed in a vertical plane between the mucous membrane or in the interperichondrial space to control postoperative hematoma A thin strip of preserved or fresh cartilage may be implanted The procedure outlined has been explained on the basis of a case where no correction of the external nose is necessary or where the correction already done to the external nose has been adequate

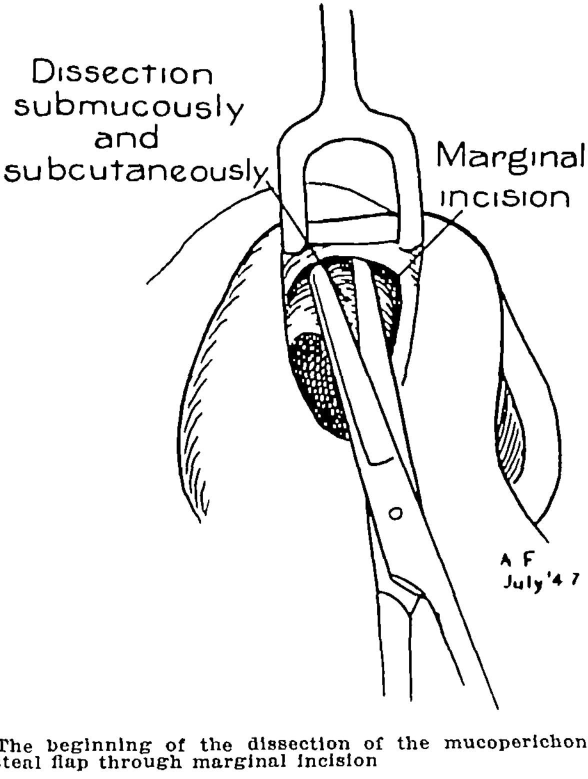


Fig 1 The beginning of the dissection of the mucoperichondreal and mucoperiosteal flap through marginal incision

and only the question of repair of the septal perforation has been required

In a case where perforation exists, following any of the above causes, particularly septal perforation following surgery, where deformity of the external nose has existed but has not been provided for, then surgical reconstruction or rhinoplasty is contemplated along with the author's method of correction of the septal perforation This will provide more adequate tissue for repair of the perforation and often will take care of larger perforations When the mucous membrane is mobilized away from the inferior surface of the upper lateral cartilage and septum, and when the septal and bony dorsum is reduced in height and the distal end of the septal cartilage removed for shortening, much more mucous mem-

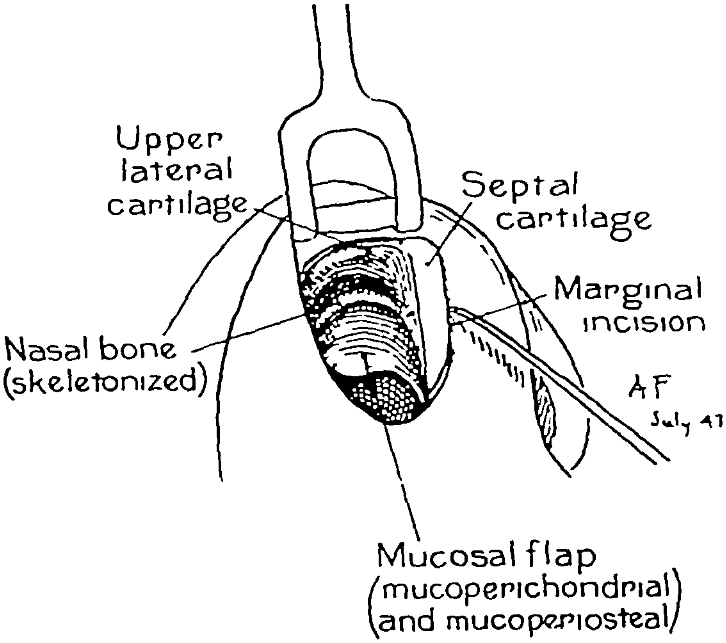

Upper lateral cartilage
Septal cartilage
Marginal incision
Nasal bone (skeletonized)
AF
July 41
Mucosal flap (mucoperichondrial and mucoperiosteal)

Fig 2 Mobilization of the mucoperiosteal flap from the nasal bone septum and upper triangular cartilage is continued until the perforation is exposed completely

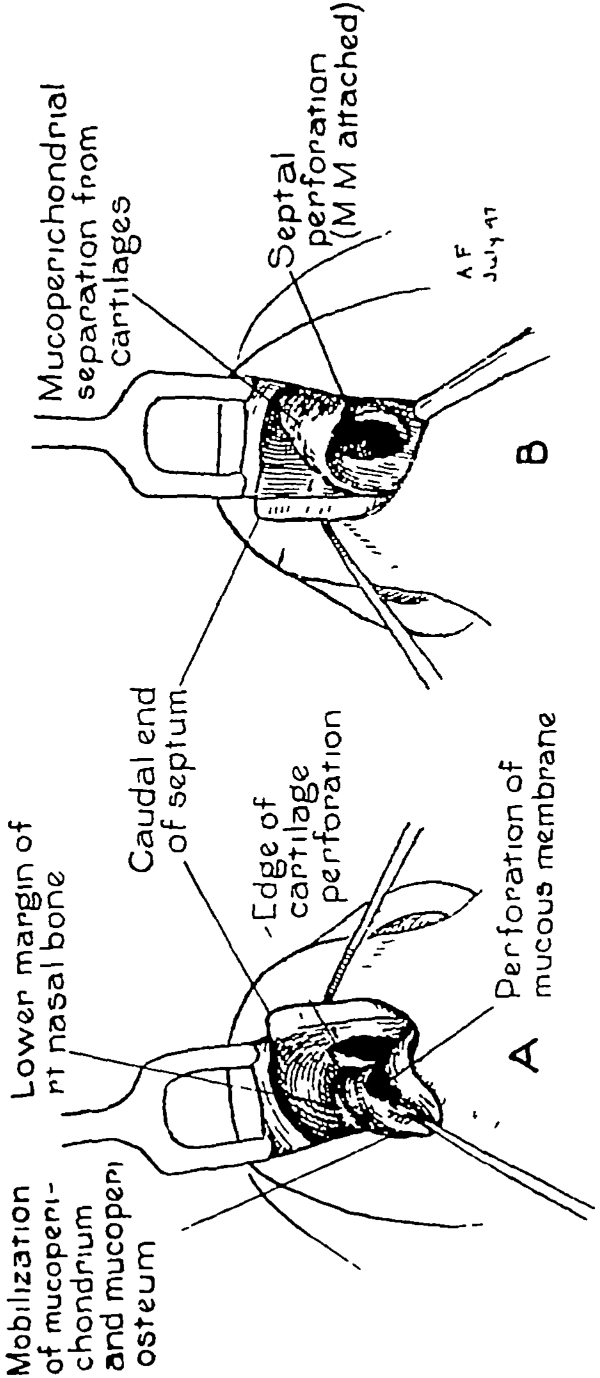


Fig 3 The completed dissection of the mucosal flap The perforation is ready for suture

brane redundancy is obtained and, therefore, larger perforations can be more adequately repaired

TECHNIQUE DIAGRAMMATIC

Reference to Fig 1 in the author's technique shows the dissection being carried out submucously and subcutaneously through the marginal incision Fig 2 reveals the exposure of the caudal end of the septum, the upper lateral cartilage and the right nasal bone have been skeletonized by mobilization of the mucoperiosteum through the marginal incision This provides a complete skeletonization of the dorsal and medial support of the nose utilized in septal perforation repair This procedure is adequate also for difficult rhinoplastic correction without perforation Fig 3 shows skeletonization of the septal perforation as viewed from the right naris There has been complete mobilization of the mucoperichondrium and

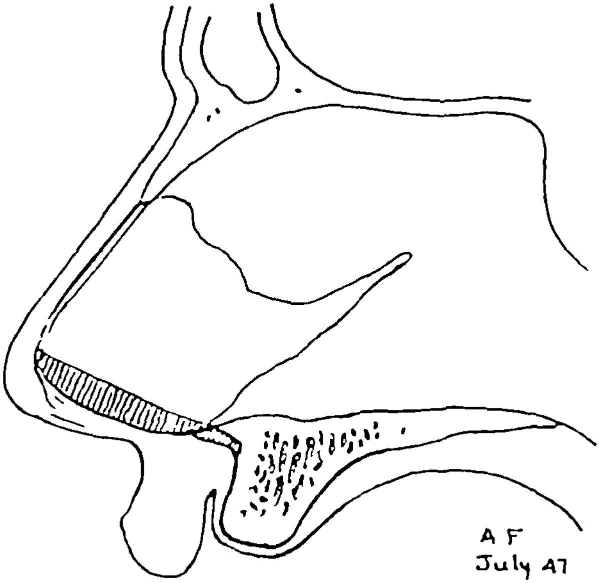


Fig 4 Shortening of the Septal cartilage provides redundant mucosal tissue for closure of the septal perforation

mucoperiosteum from the right nasal bone The edge of the perforation in the septal cartilage is clearly visible The perforation of the mucous membrane is ready for suture In Fig 3B the septal perforation is viewed from the left naris and skeletonization of the supportive structure in the left naris is being started The mucous membrane is still attached about the perforation Fig 4 shows that the removal of the caudal end of the septum and part of the anterior edge of the maxillary spine will provide adequate shortening and excess

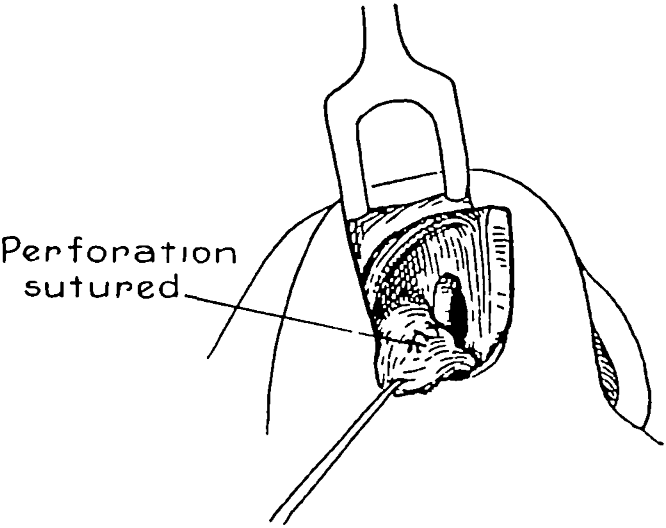


Fig 5 The right side of the mucosal perforation is closed and the left side is about to be closed

mucous membrane for adequate closure of the septal perforation Fig 5 shows the perforation sutured as viewed from the perichondrial surface

THE MUCOSAL FLAPS

It is not necessary that the roof of the mucosa occupy its apical position in the nasal bony fissure between the septum and the lateral and dorsal bony roof (In saddle noses, the mucosa formerly in the apical position occupies a horizontal plane) Further, in rib reconstruction or in bone grafts much of the mucosa is allowed to remain in place by some surgeons The author mobilizes the mucous membrane freely, however,

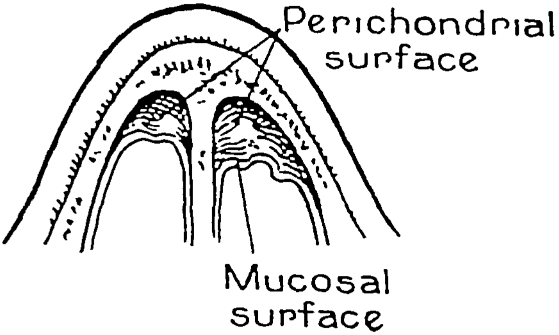


Fig 6 Diagrammatic representation of mucosal flaps replaced after surgical closure of perforations

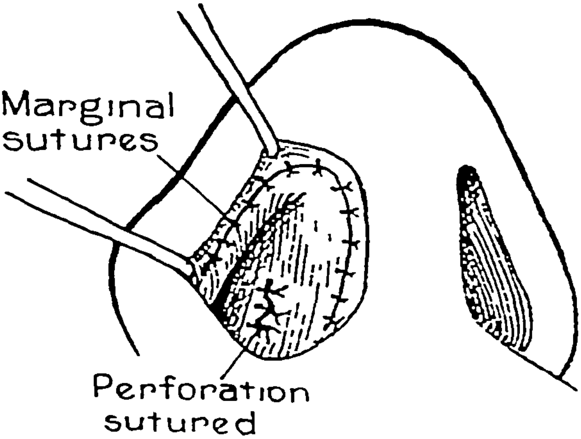


Fig 7 The appearance of the completed operation.

and after repair repositions the mucous membrane to the contiguous areas of the newly implanted graft Fig 6 is diagrammatic and shows position of flaps in nasal cavity

RESUMÉ

How to avoid septal perforations To avoid them is to repair the rent made in removing spurs and not to regard them as insignificant These are not true perforations, but they may result in ulceration and, later, perforation when

Fig 8 With retractors in place a perforation in the nasal septum is photographed but is not clearly discernible

crusting and postoperative secretion increase Perforation by puncture on one side needs no repair in the majority of cases, but, nevertheless, it is advantageous to apply a suture rather than to neglect it The advantage of developing the mucous membrane blanket flap in rhinoplastic and submucous membrane operations, separate or combined, is

Fig 9 The same patient Viewing through the right nares the perforation is mapped against the background of a metal ruler in the left nares

1 It prevents injury to the olfactory area or the Schneiderian membrane

2 The avoidance of injury to the sensory or motor nerves and vascular supply

3 The prevention of scar formation

4 The ability to visualize the abnormality of the septum,

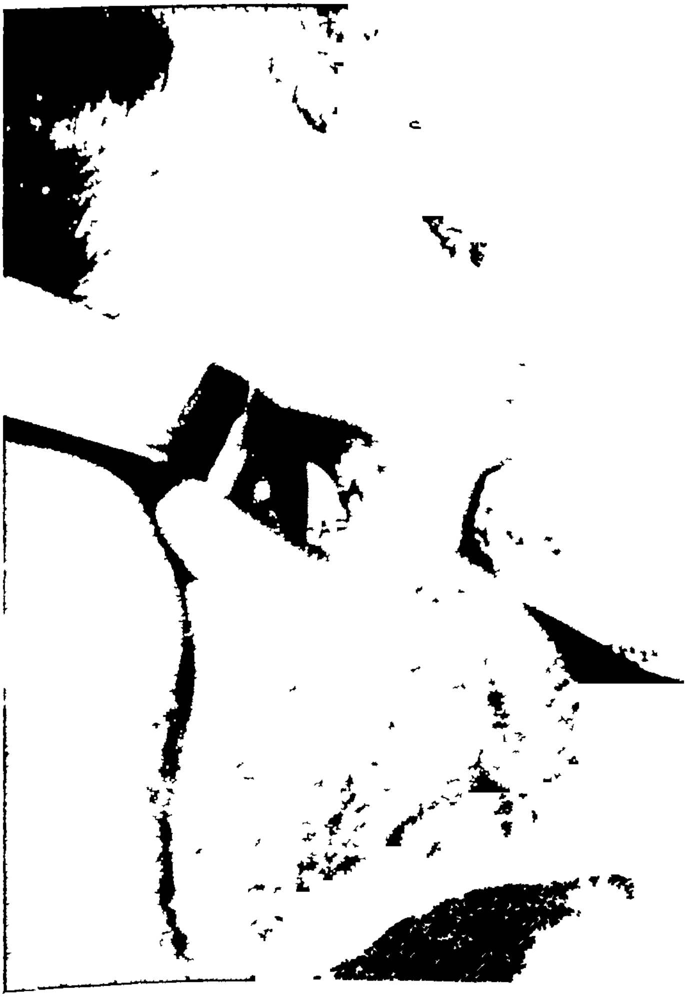


Fig 10 The same patient. Viewing through the right nares the perforation is more easily portrayed against the background of a printed card in the left nares

the vomer and the nasal bone, the knowledge of which presents the opportunity to apply adequate and accurate surgery to these supporting structures

5 Preservation of the circulation and the innervating nerves results in earlier primary healing

6 Better visualization is obtained for the necessary surgery

7 One of the most important factors in the author's technique of mobilization of the mucosal flap is the prevention of atrophic rhinitis and sinusitis by the avoidance of injury to the circulation, thereby eliminating cicatrization of the membrane flaps

The utilization of the blanket flap of the nasal mucous membrane may be ultimately of value in curing cases of atrophic rhinitis by improving the blood supply in the tunica propria In addition, it is easier than a previously recommended procedure whereby the medial bony wall of the antra are fractured medialward to prevent atrophic rhinitis

CONCLUSION

In review of the literature of the past 15 years, no one has apparently given consideration to the repair or the possibility of repair by the author's method This procedure may appear difficult, the experienced surgeon, however, will find the procedure gratifying, for it will lead to new concepts and new approaches to the septal membrane and septal cartilage problems, inasmuch as anatomical visualization and interpretations are not restricted

The sutures used in repair can be made from the mucous membrane or the perichondrial side In either case, the knot is tied on the mucous membrane side Hemorrhage is avoided and visualization enhanced Handling and tear of tissue is reduced to a minimum. Infection is unlikely Only with this type of approach can linear approximation be made, moreover, any type of approximation is possible, curved or straight, resulting from approximation of torn flaps or even from some form of Z-plasty from remade or secondary flaps The application of cartilage grafts to the area of the perforation is more justifiable, inasmuch as a blanket of mucous membrane and perichondrium is recreated to cover the area of perforation on each side

Restoration of the physiological function of the septum is more likely by utilization of the above method of rhinoplastic repair than with the use of single flaps Conversely, the complications of procedures utilizing single flaps are *1* loss of flaps with recurring perforations often larger than the original, *2* the development of synechiae with obstructing symptoms, *3* secondary infection of exposed cartilage at the donor site, *4* failure of the single flap procedure at operation because of technical difficulties involved, *5* progress of atrophic rhinitis because of altered circulation

BIBLIOGRAPHY

1 Eggston, A. A, and Wolff, D Histopathology of the Ear, Nose and Throat, p 585 The Williams and Wilkins Co, 1947

2 Howe, A C Submucous Operation Without Nasal Pack *Ann Otol, Rhinol and Laryngol*, 47 836 838, Sept 1938

3 Vaherio, E D Nasal Diphtheria as the Cause of Septal Perforations *Acta Otola*, 33 4 5, Stockholm, 1945

4 McGivern, M Simple Method for Closing Perforations of the Septum *Rec*, 151 267 268, Apr 17, 1940

5 Fletcher, R Tuberculosis of the Nose, Chronic Nonhealing Lesions *Calif and W. Med*, 52 62 64, Feb, 1940

6 Sasaki, M, and Sufmitser, S New Method of Plastic Surgery for Defects of Septum *Ann Otol, Rhinol and Laryngol*, 12 834 Oct, 1939

7 Salinger, S Deviation of Septum in Relation to Twisted Nose *Arch Otol*, 29 520 532, Mar, 1939

8 Bull, Rolderer, Jr Perforation of Septum in Chromium Worker *Soc franc de Dermat or syph Reunion dermat*, Strasbourg, 45 662 663, May, 1938

9 Foman, *S*, *et al* Plastic Repair of the Obstructing Nasal Septum *Arch Otolaryngol*, 47 1 Jan, 1948

10 Davis, J S Plastic Surgery, pp 483 495 P Blakiston s Son and Co 1919

11 Brown, J B and Kernan, J D Reconstructive Surgery of the Nose, pp 237 250 Chap 2 Surgery of Nose and Throat Nelson, 1942

12 Neivert, H, and Kernan, J D Surgery of Nose and Sinuses pp 107 117 Chap 1 Surgery of Nose and Throat Nelson, 1942

13 Phillips, W C Philadelphia F A Davis Co, pp 541 543, 1924

14 Jackson and Coates W B Saunders Co pp 77 79, 1930

15 Imperatori and Burman J B Lippincott, pp 122 124, 1935

133 East 58th Street

POTENTIAL HAZARDS FROM RADIATION TREATMENT OF HYPERTROPHIED LYMPHOID TISSUE IN THE NASOPHARYNX [*][†]

LAURENCE L ROBBINS, M D, and MILFORD D SCHULZ, M D
(by invitation),
Boston, Mass

Radiation therapy of hypertrophied lymphoid tissue in the nasopharynx, particularly in children and young adults, has become increasingly popular in the last few years[2-6] Crowe,[3] who has reported excellent results from this type of treatment, has mentioned the danger of careless use of radium. Radiologists and those familiar with the use of radium have become nervously aware of the growing tendency to give larger and larger doses and to incorporate the method as a routine part of tonsillectomy and adenoidectomy That radiation of any sort should become a routine is unwise, certainly if this does occur, the results should be checked and rechecked at intervals in order to anticipate any untoward effect Lack of an immediate reaction should not lull to rest the fears for possible latent reaction Decision to treat a benign condition with so potent an agent as X-ray, radium or any other radioactive material should be made only after careful consideration of each given case and after weighing the known beneficial results against the unknown dangers which may not appear for as long a time as 10, 20 or more years

Even today, after 30 years' experience with the use of radium and X-rays, the exact effect and the final result of this form of treatment are unknown During the pioneering years, radiologists, dermatologists, surgeons and others learned slow-

---

[*] Read at the meeting of the Eastern Section American Laryngological Rhinological and Otological Society Inc Boston Mass Jan. 7 1949

[†] From the Department of Radiology Massachusetts General Hospital Boston 14 Mass.

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 1 1949

ly and painfully something of the good and something of the bad which may result from irradiation of human tissue Immediate spectacular results often led to tremendous overenthusiasm, and it was not for some years that reports of disastrous effects of treatment to the patient and of overexposure to the operator appeared in the medical literature Because postradiation damage may be years in developing, it is the purpose of this paper to offer a well meant warning to those new to the use of ionizing radiation as a therapeutic agent, particularly regarding its use in the treatment of benign lesions in the young in whom life expectancy is long Treatment of malignant lesions in the elderly must of necessity take the chance of late radiation reactions, which if they occur may be considered the lesser of two evils

Out of a rather large number, a few examples of unfortunate results encountered during the early years of radiation therapy at the Massachusetts General Hospital, the Massachusetts Eye and Ear Infirmary and the Collis P Huntington Memorial Hospital are given to illustrate that which was discovered by the bitter experience of others in the past

Case 1 (HH 19 318) In 1919 as an infant the patient was treated for hemangioma of the forehead and two years later was considered as a satisfactory result In 1937, the treated area showed keratoses and ulceration which necessitated plastic surgery

Case 2 (RB U 536400) A young man who had a large port wine stain on the right side of his face was treated by numerous applications of radium in the "early twenties' It is probable that no one area received more than a dose comparable to that now recommended for the nasopharyngeal applicator The treatments extended over a period of three years, between 1921 and 1924 and although the result was not considered excellent great improvement in the appearance of the lesion had taken place In 1947 however the irradiated area broke down requiring extensive plastic surgery (see Fig 1)

The point to be emphasized in both of these instances is that the immediate result was considered cosmetically satisfactory, and it was not until many years later that the actual damaging effect of irradiation was recognized

Fortunately malignant degeneration is a rare sequela, but it can occur even when *1* the treated area is readily visible, *2* the patient is followed at regular intervals and *3* the surgeon is prompt in removing areas showing radiation reaction

Case 3 (EC U 609903) This man a barber, is an example of malignancy resulting from irradiation of a benign lesion Thirty years ago because of a chronic dermatitis he was treated by X rays receiving an estimated 3 500 r to the skin of his hands over a period of years (equivalent to about the dose administered by the nasopharyngeal applicator when the 12 minute treatment is repeated once) In the last 10 years his hands have shown extensive radiation change and he has had many surgical procedures for relief of painful ulcerations Within the past year an epidermoid carcinoma of the skin has developed in the irradiated area

The present radium applicator for shrinking lymphoid tissue in the nasopharynx is well known, as is the recommended dosage of 600 mg minutes, or 10 mg hours, to each side Use of this applicator has been thought to be absolutely safe because approximately 80 per cent of the ionizing radiation emergent from it are beta rays (electrons) and 20 per cent

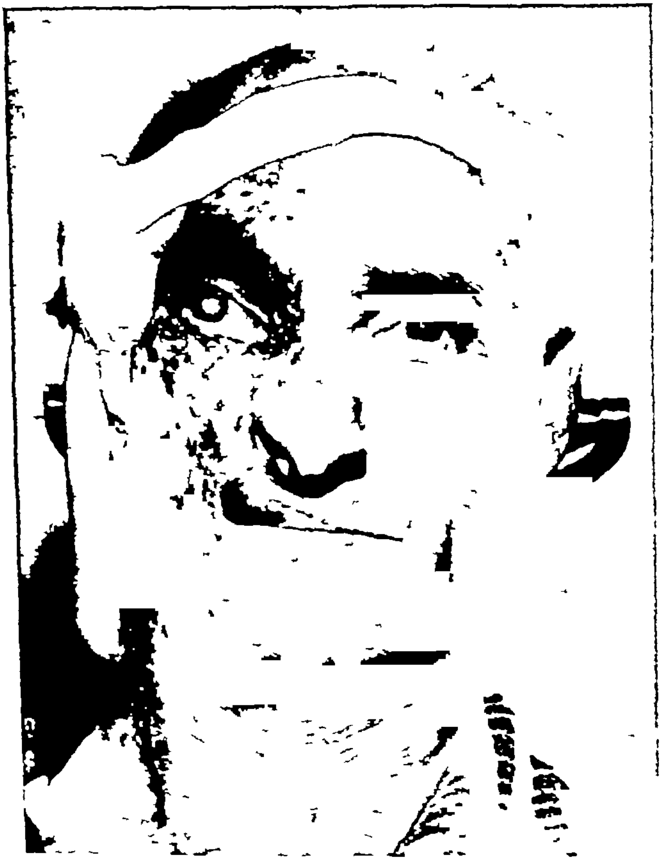


Fig 1 Case 2 Late radiation changes 24 years after treatment.

gamma rays The fact, however, that the effect of gamma rays in tissue is the result of the electrons they produce is frequently ignored That beta rays and cathode rays of X-ray tubes are electrons and that they are essentally the same, physically and in biologic effect, is likewise either unknown or ignored *Actually,* it may be said that the biologic effect of X-rays and gamma rays is, insofar as is known, entirely dependent upon a secondary electron scattering which they incite in the tissue by their absorption These scattered electrons differ only in their source and energy In other words, the changes that take place in tissue, whether irradiated by beta, gamma or X-rays, are the same, except that the depth of penetration of electron radiation is less than that of gamma and X-rays That gamma and X-rays can produce deleterious effects is amply shown in the literature of yesterday and today To believe that because of their relative inability to penetrate more than a few millimeters, beta and cathode rays are noninjurious to living tissue *is a fallacy* This was demonstrated by an accident which occurred at the Massachusetts General Hospital in 1944

Six men were exposed to scattered cathode rays from a supervoltage generator for only a short time in December of that year The three of the group who were nearest the beam and who received the greatest amount of radiation (an estimated 1,000 to 2,000 r equivalents, or about the same amount of radiation as that delivered by the nasopharyngeal applicator when applied for 12 minutes) were seriously burned *and still carry scars of their injury* (*see Fig* 2)

The able assistance of Dr Robley D Evans, of Massachusetts Institute of Technology, has been requested and given in this study He believes that measurements with the present monel applicator are highly unsatisfactory and that accurate calculations are well-nigh impossible On his advice, determination by photographic means of the approximate dosage to the surface and to the depth from various appliances was undertaken By film blackening, the Roentgen output of both the present nasopharyngeal applicator and the radon applicator previously used in this community was estimated It was found that the applicator now in use at the Massachusetts Eye and Ear Infirmary has an output intensity of 150 r /minute at the surface, which diminishes rapidly to about 47 5 r / minute at 2 mm below the surface, this equals a dose of about 1,800 r to the surface during a 12-minute treatment (10 mg hours) and slightly less than 600 r during the same time

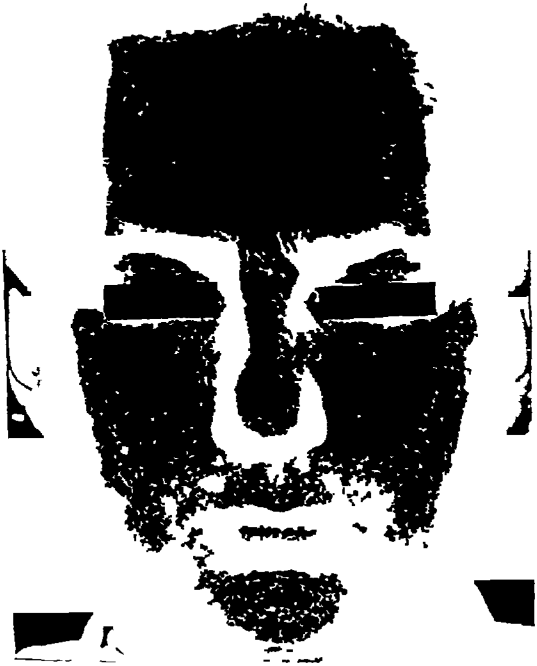


Fig 2A. 1944 Acute reaction one week after exposure to scattered cathode rays

2 mm below the surface of the tissue The old radon applicator with a wall of steel 0 4 mm thick gives a somewhat higher output, millicurie for milligram, because the internal absorption is less By these calculations, this applicator delivers about 185 r /minute at the surface and 75 r /minute at 2 mm depth These determinations are considered to be con-

servative in view of the considerably higher figures quoted by Quimby[5] and Boies[1] Quimby calculated the dose of the nasopharyngeal applicator with 0 3 mm monel delivered a dose of 1,520 r at 1 mm depth per 5 6 mg hours

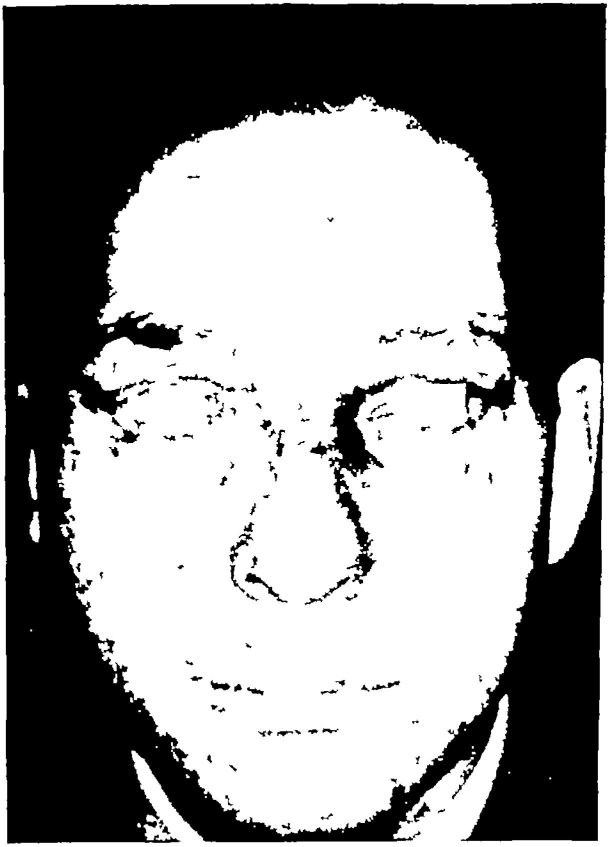


Fig 2B Four years later Note the permanent loss of eyelashes eyebrows and parts of beard and the extensive changes in the skin

Because the exact output of this applicator is still indefinite and incalculable, the question arises as to whether the recommended treatment of 12 minutes, often repeated several times, can be considered *invariably* safe No untoward results from this form of treatment have been published to date, but the recent development of the procedure eliminates the one actual test of its results, that is, time Until comparable periods of time have elapsed, the only available test lies in the review of cases in which late radiation damage to tissue other than the nasopharynx followed doses approximately equivalent to those being delivered by the monel applicator The skin, a site frequently subject to treatment and most easily observed, is best suited for such comparison Doses of 1,000 to 2,000 r to the skin as a rule show no unexpected late effects Skin atrophy usually occurs when a dose of this size is administered in a single setting, and it is well recognized that these atrophic areas are subject to breakdown following trauma or infection When breakdown occurs, healing is slow and malignant degeneration may follow Fortunately, untoward results are rare They are frequent enough, however, to make most radiologists reluctant to give more than an erythema dose in the treatment of a benign lesion

It is suggested, therefore, that in general this same principle be adhered to in the use of the nasopharyngeal applicator In other words, in the treatment of the benign lesion of the nasopharynx careful consideration of the seriousness of the lesion should be given before administering more than an erythema dose What constitutes an erythema dose with this appliance should be determined with a given instrument If this can be learned in no other way, the operator can apply his applicator to his own arm, using the hairless volar aspect of the forearm as the testing ground, and from the results be governed as to the dosage appropriate to the nasopharynx of his patient

Acute reactions to amounts of radiation similar to those now recommended for the treatment of hypertrophied lymphoid nasopharyngeal tissue are well known An erythema of the skin has been seen following as little as 400 mg minutes of mildly filtered radium, or about 700 r[5] That these reactions will usually produce some scarring is to be expected By increasing the dosage, the likelihood of severe sequelae, including atrophy, necrosis and even malignant change, becomes even greater

It seems reasonable to assume that the mucous membrane of the nasopharynx is probably as vulnerable as the skin On this premise, therefore, it can be expected that in the years to come a certain number of children now being enthusiastically irradiated by means of the monel applicator in an attempt to reduce hypertrophied lymphoid tissue may develop some degree of damage If, on the other hand, instead of the recommended dosage, the amount of radiation is limited to an erythema dose, this possibility becomes more remote It may be that no absolute conclusions can be reached as to the ultimate harmful effect of this method of treatment for another 10 years In the meantime, the fact should never be forgotten that *it is possible* for ionizing radiation applied to human tissue in the present therapeutic dosage to produce latent severe injury At the present time the procedure cannot be considered as invariably safe, and its *routine use,* without careful consideration of each individual case, is hazardous

SUMMARY AND CONCLUSIONS

In view of the present vogue for treating hypertrophied lymphoid tissue in the nasopharynx with radium, a warning of possible resultant dangers is offered

Certain unfortunate occurrences encountered by the radiologist or surgeon using radium during the early years in which he was learning the therapeutic possibilities of ionizing radiation have been presented In these cases, late radiation necrosis had followed treatment of benign lesions and many of the changes in normal epithelium, which were progressive and permanent, had resulted from radiation dosage that was approximately the same as the dose now recommended for use in the nasopharynx for hypertrophy of lymphoid tissue *The changes were latent, some not appearing for 10 to 20 years after treatment*

The nasopharynx is a location not ordinarily observed by the patient, and only by chance medical examination will early radiation changes be found Should such changes develop and progress to radiation necrosis, the nasopharynx is not a suitable site for plastic surgical repair Fortunately, breakdown of atrophic irradiated tissue occurs infrequently, and malignant degeneration with even greater rarity, but for the patient in whom either misfortune takes place, the end-result is often worse than the original condition

With the idea in mind that mistakes of the past may not be repeated in the present, certain precautionary measures are suggested *1* that the use of the monel applicator should not be routine, *2* that for benign lesions in children and young people this treatment should be carried out cautiously and only after careful consideration of each case, *3* that, except in the selected case, the treatment when given should consist of no more than erythema dose, *4* that what constitutes an erythema dose should be determined for a given applicator, and *5* that should no other means of determining the proper dosage for an applicator be available, the operator should estimate it by trial on his own skin

REFERENCES

1 Boies, L R Irradiation of Nasopharyngeal Lymphoid Tissue An Evaluation *Arch Otolaryngol* 44 129 140, 1946

2 Burnam, C F, and Crowe, S J The Monel Metal Radium Applicator Designed for Maximum Use of Hard Beta Rays in Treatment of Nasopharyngeal Hyperplastic Lymphoid Tissue *Miss Val Med Jour* 67 109 111 1945

3 Crowe, S J Increased Radiation Dosage with Monel Metal Nasopharyngeal Radium Applicator *Miss Val Med Jour*, 69 127-129 1947

4 Editorial *Jour A M A*, 138 214 1948

5 Fowler, E P, Jr Irradiation of Eustachian Tube An Anatomic, Physical and Clinical Study of a Treatment for Recurrent Otitis Media Applied to Aero Otitis *Arch Laryngol*, 43 1 11, 1946 (quotes E H Quimby)

6 Proctor, D F Polvogt, L M and Crowe, S J Irradiation of Lymphoid Tissue in Diseases of the Upper Respiratory Tract *Bull Johns Hopkins Hosp*, 83 383-428 1948

7 Robbins, L L *et al* Superficial 'Burns' of Skin and Eyes from Scattered Cathode Rays *Radiol*, 46 1 23 1946

8 Schulz, M D and Robbins, L L Dangers of Irradiation of Hypertrophied Lymphoid Tissue of the Nasopharynx In press *(Trans Am Acad Ophthal and Otolaryngol)*

STREPTOMYCIN IN OTOLARYNGIC TUBERCULOSIS*

COL A J VADALA, M C, U S Army,
Denver, Colo

In July of 1946, studies of the effect of streptomycin on tuberculosis were initiated at Fitzsimons General Hospital as a component of the cooperative study of the Army, Navy and Veterans Administration This study group has defined certain definite clinical trends in the response of pulmonary tuberculosis to streptomycin therapy[1,2,3] Extrapulmonary lesions of all types also have been evaluated under streptomycin therapy, and in most instances with very promising results Approximately 1,000 cases of tuberculosis of all types have received streptomycin at Fitzsimons General Hospital to date During this period 85 cases of tracheobronchial tuberculosis and 57 other otolaryngic lesions of tuberculous nature have been available for study It is proposed to report upon and evaluate the cases from this group which were selected for streptomycin therapy

INCIDENCE OF OTOLARYNGIC TUBERCULOSIS

For the past several years there has been a decided decrease in both the incidence and severity of tuberculosis of the upper respiratory tract and its environs Most phthisiologists feel that this reduction in the incidence and severity of upper respiratory tract tuberculosis is explained by such factors as elimination of bovine tuberculosis through public health measures, earlier diagnosis, isolation and treatment of the patient, and the therapeutic procedure of collapse therapy More recently, the general use of sulfonamides and antibiotic therapy has done much to mitigate the effects of secondary pyo-

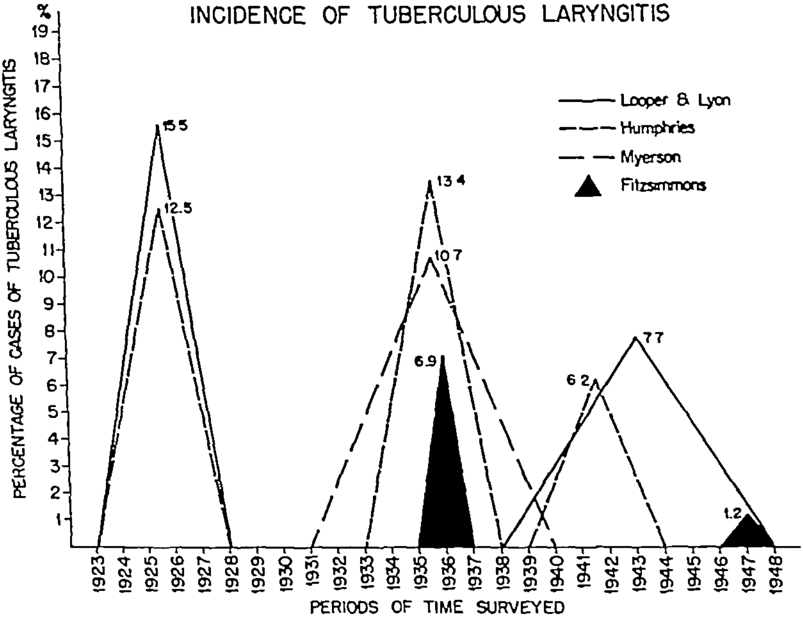
---

*Read at the meeting of the Middle Section American Laryngological Rhinological and Otological Society Inc Iowa City Iowa Jan 17 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication Jan 24 1949

genic infection in tuberculous lesions This has had a beneficial effect on the tuberculous lesion and lessened the degree of severity in the average patient

Some of the recent reports reflect trends in the incidence of tuberculous laryngitis Fig 1 has been prepared from the



reports of Humphries,[4] Myerson,[5] Looper and Lyon,[6] and from a survey conducted at Fitzsimons General Hospital, which is illustrated in Table 1

The period from July, 1946, to July, 1948, represents the two-year interval during which streptomycin became available During this interval certain cases of pulmonary and extrapulmonary tuberculosis were selected to receive streptomycin therapy Not all of the cases recorded in Table 1 received the drug, and some were terminal cases which provided little clinical information

The rather remarkable decrease in the incidence of oto-

TABLE 1 INCIDENCE OF OTOLARYNGIC TUBERCULOSIS AT FITZSIMONS GENERAL HOSPITAL

	Tbc. Patients	No Tbc Laryngitis	% Tbc Laryngitis	No Tbc Otitis Med Mastoiditis	% Tbc Otitis Media	No Tbc Pharynx	% Tbc Pharynx
July, 1935 July, 1937	4,623	317	6 9	46	1	4	25
July, 1946 July 1948	4,000	48	1 2	8	2	1	025

laryngic tuberculosis, and particularly tuberculous laryngitis (1 2 per cent of 4,000 cases), seems to parallel a lessened severity of lesions Extensive inflammatory and edematous reactions, such as characterized tuberculous laryngitides in so many cases observed ten or five years ago, are to be seen only in a few terminal cases The typical turban hood type of epiglottic reaction and rapidly destructive lesions, in particular, appear infrequently Progression of lesions to cicatrization and deformity is seldom seen

Before attributing the recent remarkable decrease in tuberculous upper respiratory infections to the utilization of streptomycin, it should be remembered that early diagnosis and other therapeutic measures which include antibiotics and judicious uses of collapse therapy have already done much to minimize these complications Streptomycin may be regarded, however, as a therapeutic measure which is competent to halt the progression of pulmonary tuberculosis and the consequent appearance of extrapulmonary lesions of the upper respiratory tract Consideration of the more specific response of otolaryngic lesions to such therapy will require continuing study

EFFECT OF STREPTOMYCIN ON TUBERCULOUS LESIONS

Much information on the effect of streptomycin on tuberculous lesions is derived from the many clinical reports of the effects of this drug on pulmonary tuberculosis In general, the drug appears to be particularly effective in fresh exudative lesions where vascularization permits ready access of the drug to the tuberculous organism As lesions become productive of scar tissue or progress to necrosis, caseation or cavitation, accessibility of the organism is lessened and effectiveness of the drug is consequently diminished

The extensions of pulmonary infection to the respiratory mucosa of the tracheobronchial tree, the larynx, nasal cavity or ear are largely those of clinical exudative lesions with relatively good vascularization, relatively thin submucosal stroma and superficial situation There would then seem to be reasonable histopathologic basis for anticipation of good clinical response in lesions of these areas An exception reserved for later comment concerns the more remote structure of the mastoid cells

As with other antibiotics, development of drug resistance is encountered in the treatment of tuberculosis with streptomycin * Where tubercle bacilli have persisted throughout the long courses of streptomycin, slightly more than half have become resistant With the short course of streptomycin (1 gm for 28 days) no cases to date have shown bacterial resistance to streptomycin It appears, however, that this problem is no simple one There are frequent instances of good clinical response of otolaryngic lesions to streptomycin in the presence of streptomycin resistant organisms from the sputum Pending further bacteriologic investigations, it is not advisable to withhold medication on the basis of this laboratory finding of streptomycin resistance without clinical trial

TUBERCULOUS LARYNGITIS

Twenty-seven cases of tuberculous laryngitis have been selected for evaluation. Six of these cases have been prepared in detail by Greif and Gould and are included with additional follow-up studies

The selection of cases has been limited to those meeting definite criteria for clinical diagnosis The characteristic appearance of tuberculous laryngitis persisting for two to three

---

*Criterion for resistance was established as growth on 10 or more micrograms of streptomycin per ml.

weeks on repeated examination by two or more experienced observers was accepted as diagnostic. In 15 cases, biopsy confirmed clinical impressions, while autopsy studies were positive in two additional cases in which biopsy was not done.

Method of Treatment. Administration of streptomycin for the cases in this report has been by the intramuscular route. Aerosolized streptomycin proved unsatisfactory early in our investigations and was soon abandoned as a means of administration. In three cases, failure of response to aerosolized streptomycin was followed by prompt response to intramuscular injection. One case responding to aerosolized streptomycin relapsed after a few weeks and subsequently responded satisfactorily to intramuscular injections. Combined therapy with aerosolized and intramuscular streptomycin demonstrated no superiority over intramuscular therapy alone and was discontinued as a method of therapy.

The dosage of streptomycin employed prior to June, 1947, was 1.8 gm. per day (divided into 0.3 gm. every four hours). After this date a dosage of 1 gm. per day (divided into 0.5 gm. twice a day) was uniformly adopted in conformity with the project outline of the Army, Navy and Veterans Administration Committee.[3] Treatment was continued 90 to 120 days with the exception of a few cases in which drug sensitivity developed or there was (fatal) termination.

Clinical observations of the response of laryngeal lesions to 1.8 gm. of streptomycin per day as contrasted with 1 gm. per day dosage have failed to show significant difference in the number of cures or rapidity of response. Recently we have treated patients with short courses of streptomycin, consisting of 1 gm. daily for 28 days, and the results have been most gratifying.

Development of Tuberculous Laryngitis in Streptomycin-Treated Patients. Among approximately 1,000 patients receiving streptomycin for pulmonary tuberculosis, only one case developed tuberculous laryngitis during active treatment. This laryngeal lesion appeared 90 days after streptomycin therapy was started and coincided with the demonstration of streptomycin resistance Three cases of tuberculous laryngitis, which are included in this report, developed tuberculous laryngitis subsequent to streptomycin therapy In each of the cases a resistant organism was demonstrated There were no cases which developed following streptomycin therapy in which resistance of the organism to streptomycin had not developed

Response of Tuberculous Laryngitis to Streptomycin Therapy In patients responding favorably to streptomycin therapy the results were immediate and gratifying from a symptomatic standpoint Pain and dysphagia disappeared within a week, at which time laryngeal examination revealed less inflammatory reaction Hoarseness abated and the larynx resumed normal appearance in as short a period as three weeks Seldom was more than six to eight weeks required for clinical cure Results are summarized in Table 2

TABLE 2

Clinically cured				19
Streptomycin sensitive			17	
Previous streptomycin therapy		3		
No previous streptomycin therapy		14		
Streptomycin resistant			2	
Previous streptomycin therapy		2		
Resistant in previous therapy	1			
Resistance during current therapy	1			
Improved				3
Streptomycin sensitive			0	
Streptomycin resistant			3	
Resistance in previous therapy		1		
Resistance during current therapy		2		
Unimproved				5
Streptomycin sensitive			0	
Streptomycin resistant			5	
Resistance in previous therapy		1		
Resistance during current therapy		4		
Total cases treated				27

From the table, it is evident that the results of treatment of tuberculous laryngitis with nonresistant organisms was uniformly good in the 17 cases of this type cited On the other hand, presence of resistant organisms did not preclude healing of the lesion in the two instances, and overall results (which include both resistant and nonresistant organisms) approximate 80 per cent Not indicated by the table was a tendency for streptomycin to ameliorate the symptoms of tuberculous laryngitis in those cases proceeding to death from extensive pulmonary tuberculosis and in which no observable change in laryngeal appearance was recorded The need for topical anesthetic applications, cauterization or superior laryngeal nerve injection was practically eliminated

Relationship of Laryngitis to Pulmonary Lesions Although the preponderance of laryngeal lesions developed in far advanced tuberculosis with cavitation or lesions producing large numbers of tubercle bacilli, the response of the laryngeal lesion did not always parallel that of the pulmonary lesion In the two cases cited in Table 2 in which laryngitis developed after previous treatment, with resultant streptomycin resistant organisms, one proceeded to death within three months with no evidence of tuberculous laryngitis on histologic examination of autopsy material, the other case was clinically cured of his laryngitis after six months' follow-up, while the far advanced pulmonary lesion remained unchanged In general, however, improvement of pulmonary and laryngeal lesions was concomitant, while those cases dying of far advanced streptomycin resistant tuberculosis represented the majority of the laryngeal lesions which were unimproved

Recurrence of Laryngitis After Termination of Therapy Of the 18 cases reported as clinically cured, 13 have been available for re-examination over intervals ranging from four to 16 months without evidence of recurrence

Two cases which might be considered recurrent were encountered In one instance of aerosol therapy alone, recurrence was noted after initial improvement Intramuscular therapy was then instituted and the lesion cleared

The other case was interesting with regard to the histopathologic findings This patient demonstrated persisting hoarseness after apparent healing Direct laryngoscopy exposed a nodular mass in the ventricle which was excised and proved to be a rather firm tuberculomatous lesion After a second course of streptomycin, complete healing ensued without evidence of recurrence after several months

As cited in the second report of the Army, Navy and Veterans Administration study,[3] statistical indication to date suggests that an 8 to 13 per cent incidence of relapse may be anticipated in all types of tuberculous lesions under streptomycin therapy

TRACHEOBRONCHIAL TUBERCULOSIS

Evaluation of the cases of tracheobronchial tuberculosis observed in the endoscopic clinic at Fitzsimons General Hospital[8] and summarized in the Army, Navy and Veterans Administration Report,[2 3] as well as the recent reports of Brewer and Bogen[9] and O'Keefe,[10] suggest a close similarity in the efficacy of streptomycin in laryngeal and tracheobronchial lesions Healing is to be anticipated in 80 to 90 per cent of all types of tracheobronchial disease and ordinarily is complete in six to 16 weeks Of greatest clinical importance is an arrest of the tendency for endobronchial disease to progress to fibrostenosis of the bronchi with the resultant serious complications of bronchial obstruction A policy of endoscopic examination and correction of endobronchial lesions prior to collapse therapy permits a more rational application of the various procedures for collapsing the lung In many cases elimination of endobronchial tuberculosis permits collapse therapy which would otherwise be contraindicated

OTITIS MEDIA AND MASTOIDITIS

Seven cases of otitic tuberculosis were treated with streptomycin The technique of treatment was that previously described for laryngeal tuberculosis All were bacteriologically positive for tubercle bacilli Table 3 summarizes clinical experience with these lesions

The few otitic lesions available for study responded well where streptomycin sensitive organs were present This was

TABLE 3

Otitis media			5
Streptomycin sensitive		3	
Healed	3		
Streptomycin resistant		2	
Unimproved	2		
Mastoiditis postmastoidectomy			1
Streptomycin sensitive		1	
Healed	1		
Mastoiditis, bilateral, facial palsy, extradural abscess			1
Streptomycin sensitive		1	
Healed	1*		

true in spite of extensive pulsonary lesions which were present in four of these cases of otitis media Most impressive was the replacement of extensive loss of the tympanic membrane and immediate arrest of deafness In two cases, gain of hearing function was noted, despite the destructive nature of the tuberculous process

The two mastoid lesions provided interesting analogies to the ineffectiveness of streptomycin in the presence of caseating or fibrotic lesions of the lungs

In the cases listed as responding satisfactorily as postmastoidectomy mastoiditis, the patient had had no improvement on streptomyin therapy elsewhere After therapy was discontinued, a mastoidectomy was performed at a second institution without streptomycin therapy On admission at Fitzsimons General Hospital six months later, there was persisting purulency from the external canal and a postauricular fistula Response to streptomycin was prompt with closure of the fistula, cessation of discharge and restoration of an intact tympanic membrane

The case with bilateral tuberculous mastoiditis evidenced progression of mastoid involvement to facial palsy and extradural abscess prior to determination that the nature of the infection was tuberculous Response to surgery and streptomycin therapy was gratifying, both in complete cessation of discharge and return of useful hearing from a severe grade of deafness

---

*Following bilateral mastoid surgery and streptomycin therapy

These two cases may well indicate that further studies will lead to modification of the "hands off" policy in dealing with tuberculous mastoiditis in favor of combined surgical drainage and streptomycin therapy

LABYRINTHINE TOXICITY

Labyrinthine symptomatology as a result of streptomycin therapy has been observed in various dosages, and certain group studies have been made

In evaluating labyrinthine manifestations, various clinical procedures have been routinely used General neurological examination with particular attention to the Romberg test, observation of positional or spontaneous nystagmus, and caloric and galvanic labyrinthine tests have been used

The caloric test used is a modification of the Kobrak test in which only 1 cc of ice water is used and the head tipped back 60 degrees to maximal position The time to the appearance of nystagmus, recorded as the latent time, is compared to the duration of nystagmus A normal ratio is regarded as 1 3 to 1 5 A ratio between 1 1 and 1 2 is considered mild depression Ratio of 1 1 or failure of response after one minute is regarded as severe depression, and further testing is not attempted, since such patients seem clinically to have no useful labyrinthine function left

We have little to add to the excellent earlier descriptions of Brown and Hinshaw,[11] Fowler and Seligman[12] and subsequent observations of these and other investigators as to the clinical signs and symptoms seen in streptomycin toxicity of the labyrinth Associated with symmetrical depression of both labyrinths and vertigo aggravated by motion, this toxicity effect is without positional or spontaneous nystagmus, and lacks directional falling reactions Aggravation of symptoms while reading led us to special investigation of the eye muscle nuclei by optokinetic nystagmus testing, study of phorias, fusion and accommodation without evidence of abnormalities

An incidence of 90 per cent labyrinthine depression beginning around the fifth week of therapy was encountered in our earlier 2 gm and 3 gm per day dosages of streptomycin It was felt that under these dosages almost all labyrinths would be damaged by continuous therapy Recovery, as noted by Fowler, proceeded by adaptation of equilibration rather than by labyrinthine recovery In a follow-up of some 34 available cases, ranging from four months to one year, an isolated example of subsequent recovery of labyrinthine response was noted

With reduction of dosage of streptomycin to 1 gm per day in a group of 50, the incidence of labyrinthine disorder dropped to only 4 per cent which were considered severe by labyrinthine testing Lesser grades of depression were observed in an additional 24 per cent Most encouraging, however, was the fact that a survey conducted four to five months after cessation of therapy demonstrated return of caloric reactions to normal in better than half of the mildly depressed cases Indications were that additional cases would recover eventually

Of interest among the mildly depressed group were several who developed depression of caloric reaction without vertigo Apparently adaptation was keeping pace with labyrinthine damage In other cases, patients who were asymptomatic in the quieter confines of the hospital complained of vertigo and ocular difficulties after resuming normal activities on the outside Driving cars over bumpy roads or difficulty in reading road signs while in motion were usual complaints In a similar manner, patients immobilized in orthopedic appliances sometimes noted vertigo for the first time when permitted greater latitude of motion

In two recent experimental groups of 50 patients, one receiving 2 gm and the other 3 gm of streptomycin per day at three-day intervals, repeated caloric tests over a period of four weeks to date have failed to show evidence of labyrinthine damage A group of cases in which the dosage of streptomycin has been reduced to 0 5 gm per day is also under study by the combined Army, Navy and Veterans Administration group These techniques appear promising with regard to labyrinthine disability providing such dosage is therapeutically efficacious

Regarding loss of cochlear function, we have observed only one case of deafness attributable to streptomycin therapy This was in a case of tuberculous meningitis Variations in audiometric studies before and after therapy were considered within normal limits on 100 patients selected at random Although there may have been an increase in the incidence of tinnitus, this very common symptoms of essentially normal individuals was not particularly impressive

SUMMARY

1 A summary of clinical experience in streptomycin treatment of otolaryngic tuberculosis over the past two years at Fitzsimons General Hospital is presented

2 The incidence of otolaryngic tuberculosis has been rapidly decreasing in recent years due to improved therapeutic measures Graphic representation of the trend in laryngeal tuberculosis is presented, showing a drop in incidence to 1 2 per cent of tuberculous cases at Fitzsimons General Hospital during the two years in which streptomycin was employed in treatment of pulmonary disease

3 Excellent response of tuberculous laryngeal lesions to either 2 gm or 1 gm per day dosage of streptomycin is recorded Clinical cures were obtained in 18 out of 28 cases, with improvement in five others Failures were related largely to streptomycin resistance of the organisms Amelioration of symptoms was noted in cases which did not respond with clinical healing There appeared to be slight tendency for recurrence after healing in the group of cases presented The results of treatment of tracheobronchial tuberculosis approximate those of laryngeal lesions

4 Otitis media responded with rapid healing in three cases and poorly in two streptomycin resistant cases Mastoiditis was controlled by surgery supplemented by streptomycin therapy in two cases

5 Labyrinthine toxicity, which was severe in 90 per cent of patients on 3 gm and 2 gm per day dosage of streptomycin, was reduced to 4 per cent incidence of severe grade of labyrinthine reaction when on 1 gm per day dosage Milder grades of labyrinthine depression, occurring in 24 per cent on the 1 gm per day dosage, showed recovery of labyrinthine responses in over half the cases

ACKNOWLEDGMENT

The author expresses appreciation to Lieut Col O P Moffitt M C and Capt W J Gould M C who have aided in selecting cases and in observing results

BIBLIOGRAPHY

1 BARNWELL, *J B*, *et al* Am *Rev Tuberc*, 56 485, 1947

2 The Effects of Streptomycin on Tuberculosis in Man Report to the Council on Pharmacy and Chemistry *Jour A M A*, 135 634, Nov 8, 1947

3 Streptomycin in the Treatment of Tuberculosis Report to the Council on Pharmacy and Chemistry *Jour A M A*, 138 584 Oct 23 1948

4 HUMPHRIES, M K, JR *Dis Chest*, 12 129 Mar Apr, 1946

5 MYERSON, M C Tuberculosis of the Ear, Nose and Throat Springfield, Charles C Thomas, 1944

6 LOOPER, E A, and LYON, I B *Ann Otol*, *Rhinol and Laryngol*, 57 754 Sept, 1948

7 GREIF, J L, and GOULD, W J *Ann Otol*, *Rhinol and Laryngol* (in press)

8 Unpublished Report of Study on Endobronchial Tuberculosis, under preparation by Capt E D Erman, M C Fitzsimons General Hospital Denver, Colo

9 BREWER, L A III, and BOGEN, EMIL *Am Rev Tuberc*, 56 386, Nov 1947

10 O KEEFE, J J *Ann Otol*, *Rhinol and Laryngo'* 57 748 Sept 1948

11 BROWN, H A and HINSHAW, H C *Proc Staff Meet Mayo Clin*, 21 347, Sept 4, 1946

12 FOWLER, E P, and SELIGMAN, E *Jour A M A*, 133 87, Jan 11 1947

Fitzsimons General Hospital

MENINGITIS FOLLOWING NASAL POLYPECTOMY *

KINSEY M SIMONTON, M D , and WALTER P ANTHONY, M D ,
Rochester, Minn

The removal of nasal polyps is usually accomplished without complication, but the possibility of serious complications is well recognized

The mucosa of the ethmoid sinuses is, from its histologic characteristics, more subject to the formation of polyps than is the mucosa of other parts of the nose This fact has double significance in the spread of infection to the cranial cavity after removal of polyps first, the anatomic proximity of the ethmoid capsule to the floor of the anterior cranial fossa, and second, the retention of infection in the ethmoid cell whose ostium is blocked by a polyp

One of the outstanding pathologic changes associated with nasal polyps is the absorption of the bony walls of the ethmoid sinuses and the turbinates as a result of pressure The intercellular septa of the ethmoid become almost nonexistent in severe cases of polyposis The middle turbinate may be absorbed, and the lamina papyracea absorbed and displaced The same process occurring in the roof of the ethmoid exposes the dura to direct contact with infected material when the ethmoid is exenterated and polypoid mucosa is removed

The small incidence of intracranial infection following removal of nasal polyps attests the skill of the rhinologic surgeon in performing this delicate procedure Due to the small incidence of complications, few are seen by any one surgeon and consequently only a small proportion of the cases which occur are reported in the medical literature

---

*Read at the meeting of the Middle Section American Laryngological Rhinological and Otological Society Inc Iowa City Iowa Jan. 17 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication Jan. 24 1949

Loeb,[1] in 1922, sent questionnaires to 5,000 practicing otolaryngologists throughout this country in search for unreported fatalities, exclusive of deaths due to anesthesia, resulting from operations on the nose and throat Two hundred and fifty surgeons reported 332 fatalities Meningitis was the cause of death following 125 intranasal operations, of which 13 followed removal of polyps

In 1916, Dabney[2] reported nine deaths following polypectomy Two resulted from meningitis, two from brain abscess, one from septicemia, and one from latent meningitis In the last case there was a preoperative history of headache and fever The cause of death was not given in the remaining three cases Dabney expressed wonder that more such deaths had not occurred, since polyps are so often superficial to periosteal or bone disease and are usually removed by avulsion This must set free infection in the presence of new areas for absorption in the middle and superior straits of the nose, a region which is always dangerous He quoted a case of Hayen, who packed a nose with gauze soaked in perchloride of iron to stop epistaxis and saw his patient die some hours later of meningitis Necropsy showed the inflammatory process plainly, and also the path of infection, which proved that the olfactory nerve fibres transmit infection through the cribriform plate to the meninges The whole length of the olfactory sulcus was stained brown and this discoloration continued throughout the sheaths of the olfactory nerves to the meninges

Davis,[3] in 1939, stated that he knew of six recorded cases of injury to the roof of the nose and had seen seven patients in consultation The injuries occurred during removal of nasal polyps with forceps or during operations for sinus suppuration in which forceps were used for the removal of the ethmoid cells All injuries occurred in the region of the posterior ethmoid cells when forceps were directed upward and backward He pointed out that such injuries may be avoided by directing forceps parallel to the roof of the nose

Imperatori,[4] quoting Turner and Reynolds,[5] stated that there are three pathways for extension of infection from the nose to the meninges *1* by way of the venous blood stream (48 per cent), *2* direct extension through the bone (43 per cent), and *3* by the olfactory perineural sheaths (9 per cent) Imperatori's series consisted of 17 cases of rhinogenic meningitis In seven the meningitis complicated paranasal sinus disease, in seven it followed intranasal operations on the sinuses, in two, submucous resection of the nasal septum, and in one a cavernous sinus thrombosis secondary to a nasal furuncle

Hagerup[6] reported 33 cases of spontaneous intracranial complications of rhinogenous origin In two the complications followed operative trauma, and in one, cerebral injury with involvement of the frontal sinus

Eagleton[7] warned of the danger of operating on patients who gave a history of headache or vomiting, because in his experience the meningitis following intranasal surgery is only a recrudescence of a former intrameningeal infection

Brunner[8] wrote that intracranial complications following removal of nasal polyps are not uncommon He stated that meningitis subsequent to intranasal surgery may be caused by *1* fracture of the cribriform plate, *2* infection of the sheaths of the olfactory bundles, and *3* acute infection or exacerbation of a chronic sinus infection He stated that when polyps are removed with a conchotome from the roof of the ethmoid sinuses or from the superior meatus a fracture of the cribriform plate is the usual cause When polyps are removed from the middle meatus with the cold snare, a chronic sinus infection may flare up, particularly if the endonasal operation did not achieve satisfactory drainage of the involved sinus Pus retained in the sinus in turn causes the chronic sinus infection to spread toward the meninges He cited a case in which meningitis and death followed extraction of polyps Evidence at necropsy indicated that meningitis was impending before removal of the polyps The surgical procedure caused acute exacerbation of the chronic sinus infection Owing to the exacerbation of the chronic infection, the infection spread rapidly into the nasal mucosa and sheaths of the olfactory bundles on both sides There was no fracture of the cribriform plate

The rôle of the network of lymph capillaries which accompany the meningeal sheaths in the olfactory mucosa in carrying infection to the intracranial space has aroused much contradictory comment Brunner[8] stated that next to the meningeal sheaths of the olfactory nerves is a network of lymph capillaries which, in the newborn infant, is believed connected with the subarachnoid space The communication is provided by small canaliculi which pass through the foramina of the cribriform plate with the filaments of the olfactory nerve This network is not in communication with the lymphatics of the respiratory portion of the nose He has traced lymphatics running in the mucosa of the lateral nasal wall from the olfactory area up to the cribriform plate, but could not trace them to the subarachnoid space Rosenvold[9] cited the contradictory literature on this subject Zwillinger[10] demonstrated this connection between the subarachnoid space and the lymphatics of the olfactory portion of the nasal mucosa by placing dye in the subarachnoid space and later finding it in the olfactory mucosa Turner and Reynolds[5] expressed the opinion that this connection does not exist They did recognize, however that peripheral lymphatic vessels take origin in the inner layer of the dura mater Rosenvold[9] stated that the clinical significance of this avenue of infection, if it exists, is greatly overestimated He demonstrated that in rabbits the spread of infection from the nasal septum to the intradural contents favored a vascular (thrombophlebitic) route

Since intracranial infection after nasal polypectomy may be caused by the flare-up of chronic sinusitis, the pathways for extension of infection from the sinuses to the meninges are important

To Hajek[11] is given credit for the first detailed study of these pathways These he outlined as follows *1* direct extension through contiguous structures with macroscopic evidence of destruction of the mucous membrane and bony walls may occur An intradural abscess then forms on the cerebral side of the bone and may give rise to meningitis, cerebral abscess or sinus thrombosis *2* Regional metastasis in which the bone bordering the cranial cavity is not destroyed may occur The discoloration of the dura and the underlying bone is the only indication that the process might have penetrated this designated area Hajek[11] concluded that this extension occurs via a perforating vein *3* Infection may spread by continuity through macroscopically intact bone To illustrate this type, Hajek cited a case of Ortman in which there was microscopic evidence in macroscopically intact bone of infection to the meninges by direct continuity through the bone

Kramer and Som[12] removed the ethmoid and sphenoid sinuses and upper part of the nasal chambers *en bloc* at necropsy in 50 cases of meningitis and studied serial sections microscopically They stated that this is the only way of ascertaining the source of the meningeal infection They said that the finding of suppuration in a paranasal sinus or of meningeal exudate at the base of the brain does not prove the rhinogenous source of the infection Further, macroscopic evidence of extension through bone is so rarely seen (in three out of the 50 cases in their series) that only serial section and microscopic study may be depended upon to determine the rhinogenous source of infection

They listed the pathways of infection proved or suggested prior to their study as *1* direct extension through the bony wall of a diseased sinus as a result of osteomyelitis (Turner and Reynolds, Hesse, Kramer and Som) , *2* lymphatic extension via perineural lymph sheaths (Jacobsgaard, Turner and Reynolds) , *3* venous spread via perforating vessels to the cavernous sinus (Hajek) , *4* congenital dehiscences, and *5* metastasis during sepsis Kramer and Som demonstrated all these except metastasis due to sepsis, and added two others

Before we list the pathways demonstrated by Kramer and Som, we shall refer briefly to the pertinent anatomy as given by these authors[12] The mucosa of the sphenoid and ethmoid sinuses is separated from the cranial cavity by a common bony wall This wall varies in thickness and in structure The roof of the ethmoid sinus is composed almost exclusively of compact lamellar bone as are the roofs and walls of the sphenoid sinus when the sinus is well pneumatized Just as frequently, however, cancellous, spongy bone separates the sphenoid sinus from the sella turcica The floor of the sphenoid sinus is formed by cancellous bone containing marrow In compact bone, venules from the mucoperiosteum of the sphenoid sinus pierce the bone and communicate with one of the larger cranial sinuses or with dural vessels These vessels are surrounded by perivascular spaces which are probably lymph channels that communicate with those within the cranium

In cancellous bone, the deep layer of the mucoperiosteum sends at intervals microscopic digitals into the bone substance *These reach into the marrow spaces From the marrow spaces* diploic veins communicate with the cavernous sinus either directly or through tributaries These periosteal extensions and perivascular spaces furnish avenues for spread of infection from mucosa to bone to cranial cavity

The pathways or methods of extension demonstrated by Kramer and Som[12] are as follows

1 Osteitis and osteomyelitis may permit spread through the bone Osteitis may cause necrosis of lamellar bone which lacks marrow On microscopic examination in such cases, loss of lamination, disappearance of bone corpuscles and peripheral erosion are evident This state may lead to gross dehiscence with direct approximation of the sinus and the dura Osteomyelitis of cancellous bone occurs *1* by direct spread into bone from the inflamed mucosa along pre-existing mucoperiosteal extensions, *2* by formation of a subperiosteal abscess with direct exposure of bone to suppuration, and *3* by extension of microscopic purulent phlebitis from the mucosa into the spaces in the marrow Extension to the bone occurred after an acute exacerbation of the chronic infection In most cases extension is of this type

2 In one case in their series of 50 cases spread was via the perineural lymph spaces They stated that perineural infection around the larger radicles above the cribriform plate is frequently seen in suppurative meningitis This finding, however, does not imply spread from the nose by perineural pathways unless the perineural sheaths of small radicles of the olfactory nerve below the cribriform plate are also infected When they are not, the large radicles above the cribriform plate are probably filled with purulent material by seepage from the affected subarachnoid space into perineural sheaths as a result of high cerebrospinal fluid pressure

3 Perivascular lymph channels also were found to be a pathway for infection Acute flare-up of a submucosal abscess causes a break through the capsule of the abscess to the subperiosteal space Infection is spread from this point by the perivascular lymph channels of the perforating vessels through the entire thickness of the bone An extradural abscess is formed at this site

4 Vascular spread by venous channels was noted Vessels connecting the mucoperiosteum with the cranial sinuses and their tributaries may become the site of thrombophlebitis This is the usual manner in which infection spreads from the frontal sinus to the dura Extension of infection from the sphenoid and ethmoid sinuses by this means is rare

5 Congenital bony dehiscences may permit direct spread of infection

6 Spread through a persistent craniopharyngeal pouch occurred in one case

CASES STUDIED

During the past two years five patients have been observed at the Mayo Clinic who developed acute purulent meningitis following intranasal operation for removal of nasal polyps Ethmoidectomy was performed in each case All patients recovered

No information is available to demonstrate the mode of infection of the intracranial space One fact stands out in all cases headache, the sentinel sign of impending intracranial complication, was noted within 36 hours after the operation, and in four of the five cases the diagnosis of meningitis was definitely established within this period The rapidity with which intracranial infection developed, in our opinion, indicates that infection reached the intracranial space by either *1* trauma to the roof of the ethmoid or the cribriform plate, or *2* extension along a preformed pathway, the perforating veins communicating with meningeal veins, the perivascular lymph channels, the olfactory nerves or the perineural lymph spaces It does not seem reasonable that meningitis could develop as the result of osteomyelitis and subdural abscess in so short a time The absence of signs of thrombosis of major intracranial venous sinuses indicates that extension did not occur by way of veins communicating with these sinuses

The surgical technique employed in operations in these cases did not differ from that used in other similar cases in which intracranial complications did not develop Presenting polyps were removed with the cold snare The ethmoid cells were broken down with curettes and tissues removed with alligator biting forceps, care being taken not to apply force in a direction toward the roof of the ethmoid cavity Evidence of chronic sinal infection was present in these cases Infection is the rule when polyps are of long standing and its presence does not indicate that risk of operation in these cases was unusual A pack of petrolatum gauze was placed in the nasal chamber in two of the five cases to maintain the position of radium applicators The radium was removed after three hours, the packs after 24 hours We have no adequate explanation for the occurrence of intracranial infection in this group of patients

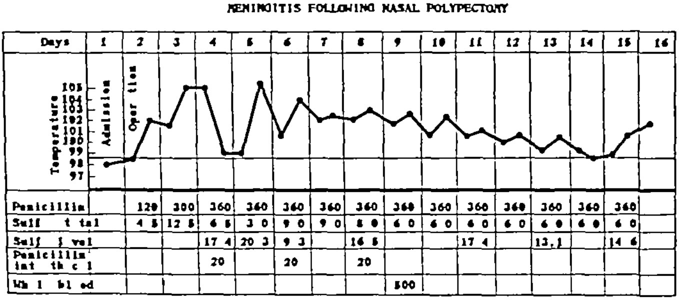
REPORT OF CASES

Case 1 (see Fig 1) A white man, aged 72 years, was examined Dec 12, 1946 He had undergone nasal polypectomy in 1925 and 1938 In 1931, submucous resection of the nasal septum and a Denker operation on the right antrum had been performed

On examination at the clinic, large polyps arising from the region of the middle meatus were present in each nasal chamber No pus was seen in the nose Roentgen examination of the paranasal sinuses revealed thickened membrane and polypoid hyperplasia

On Dec 24, 1946, with the patient under local anesthesia obtained by use of cocaine and procaine hydrochloride, numerous large polyps were removed and the ethmoid cells were exenterated Radium was applied to the ethmoid area on each side

On Dec 25 1946 the patient complained of generalized headache and malaise Examination revealed slight rigidity of the neck The temperature rose rapidly to 105° F Spinal puncture was done and cloudy fluid was withdrawn The spinal fluid contained 4 100 polymorphonuclear leucocytes per cubic millimeter Culture revealed Diplococcus pneumoniae, group D



Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Penicillin		120	300	360	360	360	360	360	360	360	360	360	360	360	360	
Sulf total		4 5	12 5	6 5	3 0	9 0	9 0	8 0	6 0	6 0	6 0	6 0	6 0	6 0	6 0	
Sulf level				17 4	20 3	9 3		16 5			17 4		13.1		14 6	
Penicillin intrathecal				20		20		20								
Whole blood									500							

Fig 1 Temperature chart Case 1

Treatment consisted of administration of sodium sulfadiazine and sodium sulfamerazine by the intravenous route These drugs were given by the oral route when the patient was able to cooperate The concentration of sulfonamide was 17 4 mg per 100 cc of blood on Dec 26 1946, and was maintained at more than 15 mg per 100 cc until Jan 11 1947 Following this the dosage was reduced and use of the drug was discontinued on Jan 15 1947

The sodium salt of penicillin was administered in doses of 30 000 Oxford units every three hours by the intramuscular route In addition, the patient was given 20 000 Oxford units of penicillin by intrathecal injection on Dec 26, 27 and 28, 1946

On this regimen the temperature subsided gradually and reached the normal level Jan 5 1947

On Jan 7 1947 symptoms of acute infection of the abdomen developed Laparatomy was performed and an acute gangrenous gallbladder with stones was removed Recovery ensued and the patient was dismissed Feb 4 1947

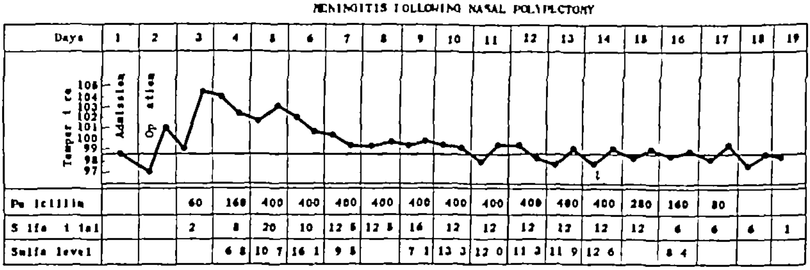
Case 2 (see Fig 2) A white man, aged 45 years, was admitted Feb 4, 1947 He complained of nasal obstruction which had been present all his life History did not reveal symptoms of allergy

Examination revealed polyps in each middle meatus Polyps blocked the choana on the left side Thick pus was present in each nasal chamber Roentgen examination revealed thickened membrane in all the sinuses

Feb 10, 1947, with the patient under local anesthesia, bilateral intranasal operation was performed Polyps were removed from the middle meatus on each side The anterior ethmoid cells were exenterated The intercellular septa were very thin The cells contained inflamed mucosa and pus Nasoantral windows were made in each inferior meatus The nose was not packed

On Feb 11, 1947, at noon, the patient noted headache and had a chill with sharp rise of temperature to 104° F He vomited and had an involuntary bowel movement in bed At 6 p m, slight nuchal rigidity was noted On Feb 12 the typical picture of meningitis was present Spinal puncture was done and cloudy fluid was withdrawn Laboratory examination of the spinal fluid revealed 5,700 cells per cubic millimeter Diplococcus pneumoniae, group D was isolated by culture

Treatment for meningitis was started on Feb 11, 1947 Penicillin was administered by the intramuscular route in doses of 20 000 Oxford units every three hours This dose was increased on Feb 13, 1947, to 50,000 units every three hours This treatment was discontinued on Feb 25, 1947



Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Penicillin			60	160	400	400	400	400	400	400	400	400	400	400	280	160	80		
Sulfa total			2	8	20	10	12 5	12 5	16	12	12	12	12	12	12	6	6	6	1
Sulfa level				6 8	10 7	16 1	9 5		7 1	13 3	12 0	11 3	11 9	12 6		8 4			

Fig 2 Temperature chart Case 2

Sulfadiazine was administered orally in doses of 1 gm every four hours on Feb 11, 1947, this dose was increased to 2 gm every four hours on Feb 12 and its use was continued to Feb 24, when it was reduced to 1 gm every four hours This dosage was supplemented by the daily administration of 10 to 12 5 gm of sodium sulfadiazine by the intravenous route from Feb 13 to 16 Despite these large doses, the concentration of sulfadiazine in the blood exceeded 11 mg per 100 cc on only one of these days Feb 14, when it was 16 1 mg Therapy was discontinued Feb 27, 1947

The temperature subsided by lysis and reached an approximately normal level on Feb 16, 1947

A complication which caused considerable concern was the development of marked rigidity of the abdomen 24 hours after the onset of symptoms of meningitis In view of history which was suggestive of peptic ulcer, perforation of peptic ulcer was suspected Because of the patient's poor condition a nasal tube was inserted into the duodenum and continuous suction was applied The patient at no time suffered from pain in the abdomen, or exhibited tenderness consistent with perforated peptic ulcer Rigidity of the abdominal muscles subsided after three days

A second complication which explains the difficulty of maintaining the desired concentration of sulfonamide in the blood was the development of symptoms suggesting diabetes insipidus The specific gravity of the urine before operation was 1 027, and the day following operation was 1 020 After the onset of meningitis the specific gravity of the urine gradually decreased and reached the low level of 1 001 The patient exhibited marked thirst and drank large quantities of water After he was allowed out of bed he filled his own pitcher so that fluid charting was inaccurate This condition improved after recovery

The patient was dismissed from the hospital on Feb 27, and from the clinic on March 6, 1947 He returned Dec 1 1948 Mucopus was present in the nose No polyps were noted Specific gravity of the urine was 1 020

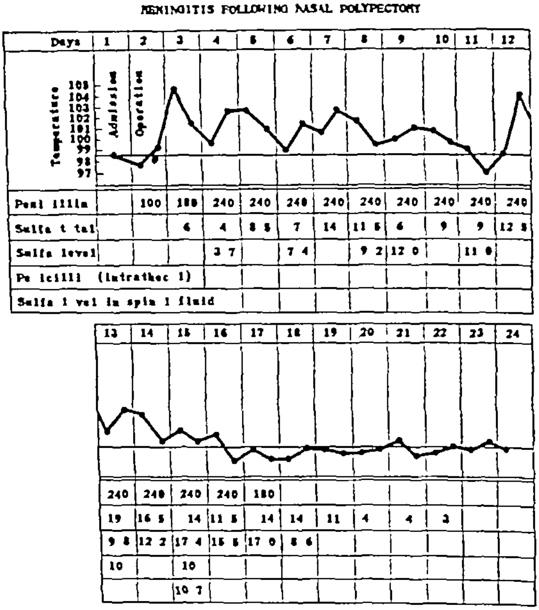


Fig 3 Temperature chart, Case 3

Case 3 (see Fig 3) A white man, aged 48 years registered July 18 1947 He complained of nasal obstruction and sneezing when in contact with farm dusts In January, 1947, he caught cold and had suffered from asthma ever since A diagnosis of asthmatic bronchitis was made Nasal examination revealed bilateral polyps in the middle and superior meatuses Pus was present in the choanae on repeated observations Lavage of the antra was done with clear return. Roentgen examination showed thickened membrane in all the paranasal sinuses Skin sensitization tests showed slight reactions to a few inhalant allergens

On July 24 1947, with the patient under local anesthesia an intranasal operation was performed Frank pus was found in both sphenoid sinuses and in the right maxillary sinus The walls of the anterior and posterior ethmoid cells were extremely thin and decalcified The ethmoids were exenterated Radium was applied to the sphenoethmoid recess on each side and maintained in position for three hours by a pack of petrolatum gauze The pack was removed 24 hours later

On July 25, 1947, the patient complained of severe generalized headache and the temperature rose abruptly to 104 6° F He had no chills and no vomiting Slight rigidity of the neck was noted On July 26, signs of meningitis were well developed Spinal fluid withdrawn contained 6 378 polymorphonuclear cells per cubic millimeter Diplococcus pneumoniae was isolated by culture

Treatment consisted of sulfadiazine administered by mouth The initial dose was 4 gm , the second dose, four hours later, was 2 gm and subsequently doses of 1 gm were given each four hours After 24 hours the concentration of sulfadiazine was only 3 7 mg per 100 cc Dosage was increased to 1 5 gm every four hours, which gave concentrations in the blood of 7 4 mg per 100 cc The patient did not tolerate higher doses of sulfonamide by mouth Oral medication was supplemented by intravenous injection of 5 to 10 gm of sulfadiazine daily, beginning Aug 3, 1947, with resulting concentrations in the blood of between 12 and 17 mg Penicillin was administered by intramuscular injection of 20,000 units every three hours, beginning at the time of surgery The dose of this drug was increased to 30 000 units every three hours at the onset of signs of meningitis Spinal fluid was removed on July 26 and 31 and on Aug 3, 4, 6 and 12, 1947

The patient made slow but steady improvement from the onset of his symptoms until Aug 3, 1947, when headache vomiting and nuchal rigidity recurred At this time sodium sulfadiazine was given by intravenous injection Improvement again followed, the temperature reaching normal Aug 12, 1947 He was dismissed from the hospital Aug 15 and from the clinic Aug 19, 1947

The patient was observed in October, 1947 Pus was present in the upper part of the right nasal chamber This diminished after local treatment. No polyps were noted The patient had had no severe attack of asthma since his operation He was again observed Sept 1 1948, at this time he reported that he was having mild symptoms of asthma almost daily but no severe attacks A small polyp was present in the left nasofrontal duct and pus was observed around the polyp The polyp receded after removal of the pus with a suction cannula

Case 4 (see Fig 4) A white man, aged 41 years was examined Jan 5, 1948 His presenting complaint was "gas on the stomach"

Examination of the nose was done because he complained of drainage of pus from the nose Rhinoscopy revealed atrophy of the nasal mucosa Multiple polyps which were bathed in pus were seen to arise from each middle meatus Roentgenograms showed thickened membrane and possibly polyps in each ethmoid Lavage of the antra returned mucopurulent material from the right, but the return from the left was clear

On Jan 23, 1948, an intranasal operation was done with the patient under local anesthesia The anterior ethmoid cells were exenterated The ethmoid cells contained hyperplastic mucosa and pus The nasoantral wall was removed in each inferior meatus Polyps were present in the left antrum

On Jan 25 1948 the patient complained of severe bifrontal headache, which he stated had begun the evening before Signs suggesting meningitis were noted Cloudy spinal fluid was withdrawn The cell count was inaccurate, due to clumping of the leucocytes Smear and culture did not reveal micro-organisms

On the evening of Jan 25, 1948, a rise in temperature was noted, flexion of the neck was slightly limited, and Kernig's sign was slightly positive on the right side On Jan 26, clinical signs of meningitis were definite, although the temperature was lower and the patient felt much better

Sulfonamide therapy consisted of sulfamerazine given orally Four gm were given at the first dose, followed by four doses of 2 gm each and continued with 1 5 gm each four hours thereafter This dosage resulted in a concentration of 16 1 mg of sulfonamide per 100 cc of blood at the end of 24 hours, and the concentration was maintained between 14 6 and 20 3 mg Penicillin was administered concurrently

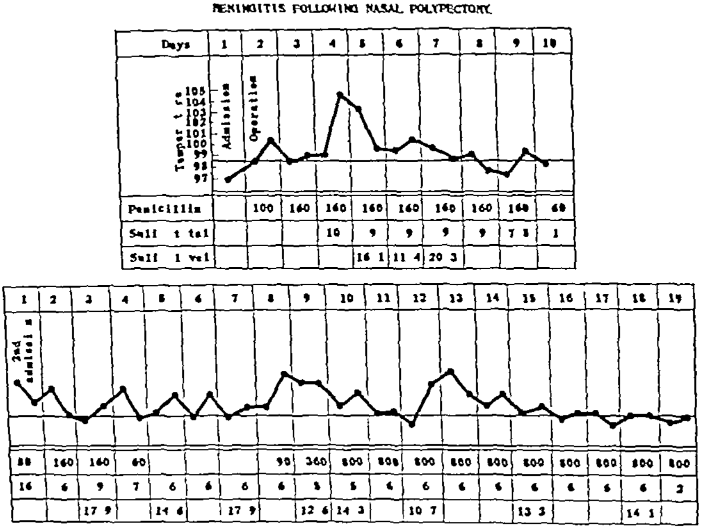


Fig 4 Temperature chart, Case 4

This patient responded rapidly to treatment The temperature dropped to 100° F one day after the initial rise and became normal Jan 29 The patient was dismissed from the hospital Jan 31, 1948 He was instructed to take 1 gm of sulfamerazine four times daily

The headache recurred the evening of Feb 1 1948, and the following morning projectile vomiting occurred He was readmitted to the hospital The temperature was 101° F Neurologic examination and examination of the ocular fundi gave negative results During the following eight days several slight rises of temperature were noted The patient complained of moderate headache Examinations repeatedly gave negative results Brain abscess or localized meningitis was suspected The patient remained in the hospital until Feb 21, 1948 At this time his temperature had remained normal for seven days Observation was continued until Feb 28 1948 At the time of dismissal he had had no headache or other complaints for two weeks

Treatment following readmission to the hospital consisted of intramuscular administration of 20,000 units of penicillin every three hours from Feb 2 to 5, 1948, when the dose of penicillin was increased to 100,000 units every three hours Sulfamerazine by mouth, and sodium sulfadiazine by intravenous injection were given in amounts adequate to maintain concentrations of more than 12 mg of the drug per 100 cc of blood Following his dismissal from the hospital he was given 600,000 units of procaine penicillin intramuscularly daily until his dismissal from the clinic

Case 5 (see Fig 5) A white man, aged 61 years, was first examined at the clinic on June 2, 1948 He complained of nasal obstruction of 15 years' duration Nasal polyps had been removed in 1943 and again in 1947 He had suffered from headache in both the supraorbital and occipital regions The occipital headache was relieved by massaging the muscles of the neck He sneezed a few times each day

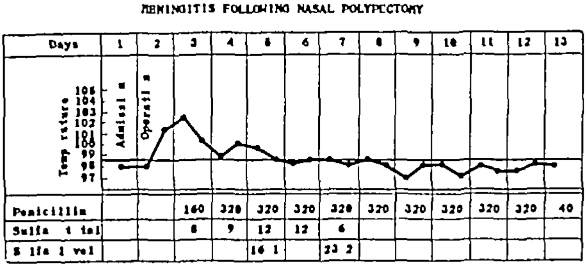


Fig 5 Temperature chart Case 5

Examination revealed multiple polyps in each side of the nose A large polyp protruded from the choana on the right side The sinuses could not be entered by probing Roentgenograms revealed thickened membrane and secretion in all sinuses of the anterior group Those of the posterior group were clear General physical examination gave negative results Systolic blood pressure was 120 mm of mercury, diastolic pressure was 85 mm

An intranasal operation was done June 5 1948 Local anesthesia was used Multiple polyps were removed from the right ethmoid area by snare and biting forceps The walls of the ethmoid cells were thickened and the cells were filled with polyps The ethmoid was exenterated A nasoantral window was made and a huge polyp was removed from the right antrum The mucosa forming the ostium of the sphenoid sinus showed polypoid degeneration The ostium was enlarged The mucosa of the sphenoid was normal On the left side polyps were smaller Findings in the ethmoid capsule were similar to those on the right Polyps were removed and the ethmoid was exenterated The left sphenoid sinus was large and presented through a dehiscence in the root of the middle turbinate At this point the patient went into a state of collapse and the operation was discontinued No packs were used

The episode at the end of the operation consisted of paralysis of the right side of the body and aphasia for speech The patient was observed closely Motion of the extremities returned one hour and speech returned two hours after the onset of the complication This episode was interpreted as being due to vascular spasm

The morning following operation the patient complained of generalized headache Speech was clear and there was no paralysis He complained of pain in the muscles of the neck Two hours later he became stuporous and the temperature rose to 102 8° F Moderate rigidity of the muscles of the neck was present. Spinal puncture was done The spinal fluid was turbid and contained leucocytes too numerous for accurate count Culture revealed nonhemolytic streptococci

Penicillin in doses of 40 000 units was administered every three hours by intramuscular injection At the onset of symptoms of meningitis, 5 gm of sodium sulfadiazine were administered intravenously Following this initial dose the patient was given 6 gm of sulfadiazine 3 gm. of sulfathiazole and 3 gm of sulfamerazine daily Sulfonamide medication was discontinued after four days because of crystalluria Concentrations of sulfonamide in the blood were 16 1 and 23 2 mg per 100 cc

The patient made excellent progress His temperature became normal on the third postoperative day and remained normal Headache and numbness of the right leg persisted for three days He was dismissed from the hospital June 16, 1948 10 days after the onset of meningitis He was dismissed from observation June 21, 1948

TREATMENT

Study of this small group of cases gives support to the basic rules for chemotherapy of acute infection These rules, stated briefly, are treat early, treat adequately and treat long enough In all cases administration of a drug of the sulfonamide series was instituted immediately after the onset of intracranial complication was recognized Variations in the initial dosage of the drug and in the time required to achieve adequate concentration of the drug in blood are reflected graphically in the response of the patient to treatment In two cases in which treatment was reduced too early, meningeal symptoms recurred The dosage of sulfonamide should be controlled by determinations of the concentration of the drug in the blood In Case 2, because of the tremendous fluid exchange, concentrations of sulfonamide remained low despite seemingly adequate doses of the drug In Case 5, the same dose resulted in high concentrations of the drug in the blood

Penicillin is of limited value in prevention or treatment of postoperative meningitis of nasal origin Three of the five patients in this series received penicillin from the time of operation Penicillin does not penetrate nerve tissue or the meninges, however, penicillin is of value in reducing the continued spread of infection from the primary focus to the meninges and for this reason should be administered to these patients

COMPLICATIONS

Symptoms of acute abdominal disease developed during the course of the illness in two cases It is fortunate that in the case in which laparotomy was necessary, the abdominal infection developed after recovery from the meningitis Certainly risk of performing a major surgical procedure on a patient suffering from severe meningitis would be high

Rigidity of the abdominal wall may be due to meningism The occurrence of this symptom in a patient severely ill and semistuporous creates a diagnostic problem of the first magnitude The decision in favor of conservative management in Case 2 was a fortunate one

Development of symptoms suggesting diabetes insipidus in Case 2 which were transient in duration indicates pituitary dysfunction resulting from inflammation The influence of these symptoms on treatment of the infection has been noted It is probable that strict limitation of intake of fluid would have been valuable in this case

COMMENT

From the study of these five cases certain points should be emphasized in summary

1 Meningitis is a definite risk in operations on the ethmoid for removal of nasal polyps

2 Penicillin administered postoperatively does not prevent meningitis

3 The sulfonamides are the most valuable drug for treatment of meningitis

4 Successful results require early, adequate and prolonged sulfonamide therapy

5 Dosage of sulfonamides should be controlled by determination of the concentration of the drug in the blood

6 Complications of meningitis may involve systems outside the central nervous system

REFERENCES

1 LOEB, H W Fatalities Following Operations Upon the Nose and Throat Not Dependent Upon Anesthesia—A Study of 332 Hitherto Unreported Cases *Ann Otol., Rhinol and Laryngol*, 31 273 296, June, 1922

2 DABNEY, VIRGINIUS Deaths Attributable to Intranasal Operations and Other Instrumentation a Critical Review with Report of Eight Unpublished Cases One Personal. *Surg, Gynec and Obstet*, 22 324 330, Mar 1916

3 Foreign Letters Complications of Intranasal Surgery *Jour A M A*, 113 2072 Dec 2, 1939

4 IMPERATORI, C J Symposium on Bacterial Meningitis III —Differential Diagnosis of Suppurative Meningitis Caused by Paranasal Sinus Disease with Some Suggested Prophylactic Measures THE LARYNGOSCOPE 47 306 310, May, 1937

5 TURNER, A L and REYNOLDS, F E Quoted by C J Imperatori [4] also quoted by L. K. Rosenvold [9]

6 HAGERUP GUNNAR The Rhinogenous Intracranial Complication *Acta Oto-Laryngol*, 24 321-378 1936

7 EAGLETON, W P Meningitis from Sphenoid *Trans Am Laryngol, Rhinol and Otol Soc*, 38 51-62 1932

8 BRUNNER HANS Intracranial Complications of Ear Nose and Throat Infections Chicago The Year Book Pub, Inc 1946 pp 41-42 252 257

9 ROSENVOLD, L K Intranasal Suppuration Secondary to Disease of the Nasal Septum, a Survey of the Literature a Report of Cases and Animal Experiments *Arch Otolaryngol*, 40 1 16, July, 1944

10 ZWILLINGER, H Quoted by L K. Rosenvold [9]

11 HAJEK, M Pathology and Treatment of the Inflammatory Diseases of the Nasal Accessory Sinuses (Translated by J D Heitger and F K Hansel) St. Louis The C V Mosby Co, 1926 Ed 5 Vol 2, pp 612 620

12 KRAMER, RUDOLPH and SOM, M L. Intracranial Pathways of Infection from Diseases of the Sphenoid and Ethmoid Sinuses *Arch Otolaryngol*, 32 744-770 Oct. 1940

USE OF THE ALNICO MAGNET IN BRONCHOSCOPY AND ESOPHAGOSCOPY

HERMAN I. LAFF, M.D.,
Denver, Colo.

A recent addition to the bronchoscopist's armamentarium in the form of the alnico magnet has proven of great value for the removal of certain metallic foreign bodies from the bronchi, esophagus and stomach. Lately, I have had gratifying results with this magnet in cases which previously had presented formidable foreign body problems. The facts of its adaptability, simplicity and safety may advantageously be re-emphasized.

Silber, Kaplan and Epstein[1] reported its employment in 1943 for the removal of a padlock from a child's stomach. Equen[2] soon thereafter elaborated on its usefulness and described the specifications of the magnet he devised for use in the esophagus and stomach and of a smaller one for the tracheobronchial tree (see Fig. 1). The magnet for the esophagus and stomach is cylindrical, 5 cm. in length by 0.5 cm. in diameter, and is attached to a Levine tube, size 12F, perforated near its attachment to the metal to allow inflation of the stomach with air. A stylet in the Levine tube increases its rigidity.

The magnet for the trachea and bronchi is smaller, 4 cm. in length by 0.3 cm. in diameter, and is attached to an ureteral catheter.

Alnico[3] is an alloy of aluminum, cobalt, copper and iron. It is a permanent type of magnet, requires no electrical current to energize it and is said to be capable of lifting objects 60 times its own weight.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Nov. 26, 1948.

Although the endoscopic extraction of most foreign bodies that have been aspirated or swallowed has been satisfactorily standardized, the peroral removal of objects such as open safety pins from the esophagus and stomach,[4] and straight pins from the smaller bronchi situated close to the diaphragm, is difficult and frequently fraught with danger Where available, the use of the biplane fluoroscope has been of great assistance Unfortunately, even in some of our larger communities the biplane fluoroscope is not yet to be had Without it, the extraction of a straight pin from a bronchus too small to permit its visualization with a bronchoscope is uncertain if not impossible[5] It is just in this type of difficult foreign body problem that the alnico magnet has been found to have great usefulness, as subsequent case reports will illustrate

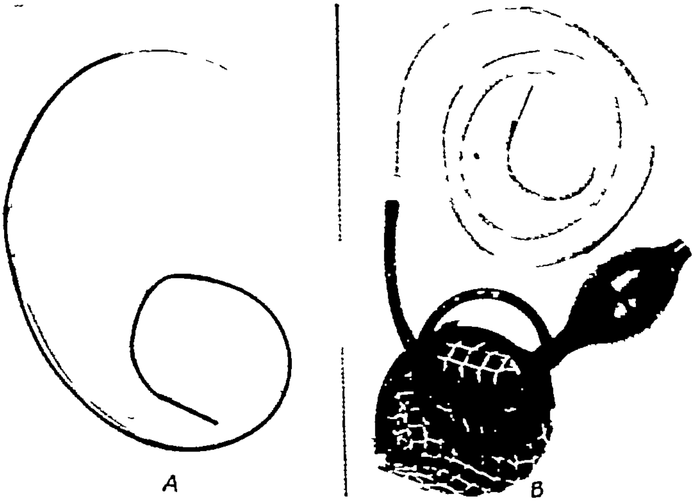


Fig 1. Alnico magnets designed by Equen for extraction of magnetizable foreign bodies At (A) is shown the magnet for use in the bronchi At (B) is the magnet for use in the esophagus and stomach with attachments for insufflating air into stomach.

Obviously, the object to be extracted with the magnet must be magnetizable metal and it is well to attempt to obtain a duplicate of the intruder to test for this quality Many of the straight and safety pins now in use are made of iron Bobby pins, which are now so frequently swallowed, may be very dramatically extracted from the stomach with the alnico magnet Peculiarly, a bobby pin seems to have great difficulty in leaving the stomach, and where no progress has been apparent for several days it would seem best to "fish it out" with the magnet and thus spare the patient and parents needless anxiety

Where an open safety pin, point up, is found lodged in the esouhagus, the magnet may be inserted as a bougie and, under ordinary fluoroscopic guidance, the pin, in contact with the magnet, is directed into the stomach By manipulations of the magnet and insufflation of the stomach with air, to allow the pin freedom of motion, the intruder may readily be flipped over so that its point now trails It may then be drawn upwards past the cardia and up the esophagus without undue resistance If it becomes detached at the cricopharyngeal constriction at the upper end of the esophagus, as it sometimes may, the pin can then simply be extracted by inserting an esophagoscope and grasping it with forceps

The question may arise as to the risk involved in the maneuvers necessary to effect a change in the presentation of the open safety pin in the stomach The answer is that it is practically *nil*, as the magnet's pull against the point of the pin would appear to be insufficient to produce a perforating or even traumatizing injury to the gastric mucosa Experimentally flipping the open safety pin with the magnet in the palm of one's own hand will demonstrate that the magnet will become detached from the object before its point will cause pain or injury to the skin

When confronted with the problem of extracting a straight pin from a peripheral bronchus, fluoroscopic guidance should also preferably be employed, as this will assist in directing the magnet into the proper branch bronchus Searching and grasping for the pin with forceps should not be the primary procedure if the use of the magnet is contemplated The magnet should be tried first, especially if the pin is point up, as with its use the point is not so apt to be caught in the bronchial wall This often happens when the pin is grasped with forceps Application of the magnet at this juncture may not succeed in removing the intruder

CASE REPORTS

Case 1 J G age six years, was seen at St Joseph's Hospital on July 19, 1946 at the request of Dr J F Harrington because of a straight pin that had become lodged in the child s hypopharynx (see Fig 2) Esophagoscopy was prepared for a few hours later An X ray taken just prior to surgery showed the pin at about the previously found level The patient was anesthetized with ether and the pin searched for but it could not be located in the pharynx or esophagus An X ray of the chest and abdomen was then made with a portable unit and the pin was found to have lodged in the lower portion of the right lung field, not far above the diaphragm (see Fig 3) A bronchoscope was inserted but the pin could not be visualized The alnico magnet was then introduced through the bronchoscope and after directing it into a posterior branch bronchus of the lower lobe of the right lung the magnet was removed and the pin was found dangling to its distal end

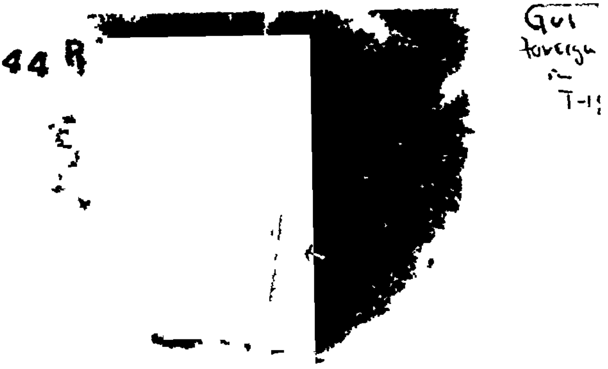


Fig 2 Straight pin in hypopharynx of a six-year-old child (Case 1)

Case 2 S D age 10 months, was seen at Children s Hospital in consultation with Dr Rex Murphy on Sept 18, 1946 on account of a *straight* pin that had lodged in the lower lobe of the right lung He prepared for bronchoscopy under makeshift biplane fluoroscopic guidance (using a portable fluoroscope in addition to the fixed one) He visualized the pin, point up in a lower lobe branch and grasped it with side-curved forceps On attempting to extract it, the point got caught in the mucosa of the bronchial wall I then inserted the alnico magnet but the pin could not be dislodged, apparently owing to the fact that its point was caught After further manipulation with forceps and with the aid of the fluoroscopes, Dr Murphy shortly thereafter was able to extract the pin

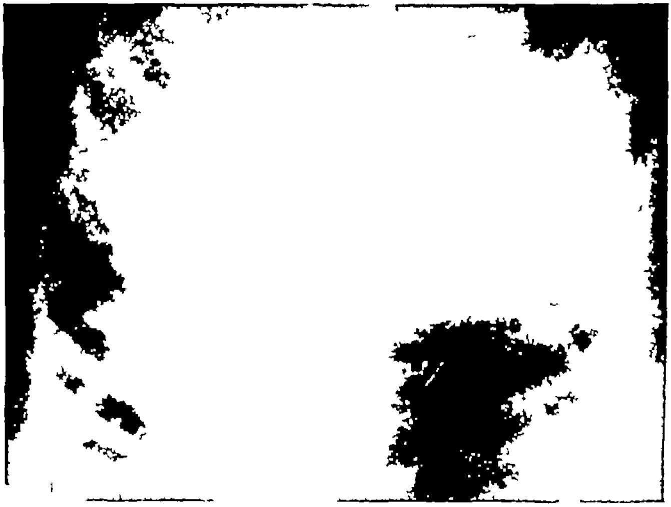


Fig 3 Straight pin shown in Fig 2 after lodging at base of right lung (Case 1)

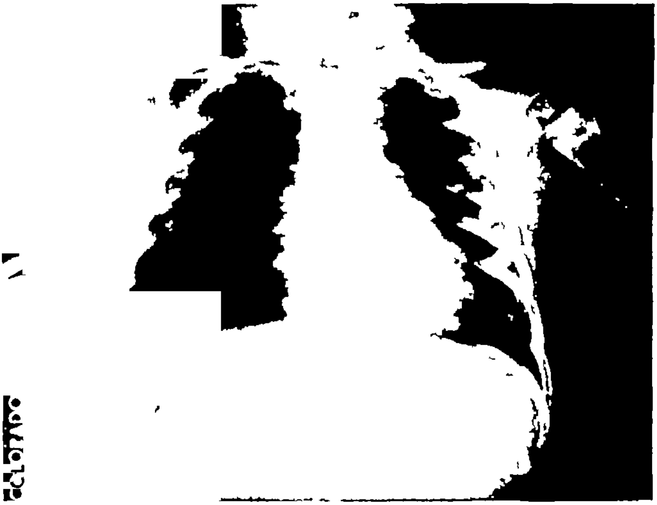


Fig 4 Open safety pin point up lodged at the lower end of the esophagus in a 10-month old child (Case 3)

Comment Experience with this case would indicate that application of the magnet for extracting a straight pin from the lung should be the primary procedure rather than attempting its use following manipulation with forceps as prior to grasping it the point is less apt to be embedded in the bronchial mucosa

Case 3 A. B age 10 months swallowed an open safety pin on Sept 28 1946 The pin with its point up was found by X ray to have lodged near the cardiac end of the esophagus (see Fig 4) A member of the bronchoscopic staff of the Colorado General Hospital was unsuccessful in his efforts to remove the safety pin An X ray taken the following day showed the pin at approximately the same level Preparation was made to use the alnico magnet the following morning however the radiogram taken just prior to surgery revealed that the pin had descended into the stomach (see Fig 5) It was felt that the possibility of the pin passing spontaneously was quite good and the contemplated procedure with the magnet was deferred on that account Surgical consultation obtained by the pediatric staff was reported to be in favor of gastrostomy It was my feeling that the magnet should be tried first and the following day this was done Under ether anesthesia the magnet was introduced into the stomach. The stomach was then inflated with air and the magnet and child were so manipulated that the spring end of the pin pointed upwards

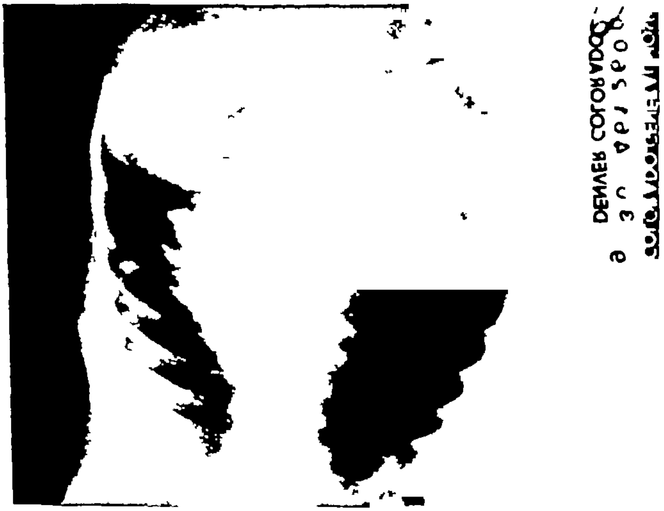


Fig 5 Open safety pin in the stomach of a child 10 months old after spontaneously leaving its site of lodgment in the lower end of the esophagus (see Fig 4) The pin was extracted from the stomach by use of the alnico magnet (Case 3)

With the point thus trailing the pin was pulled up past the cardia, then up the esophagus as far as the cricopharyngeal constriction where it became detached from the magnet An esophagoscope was then inserted and the pin extracted by means of a forceps

Case 4 P W age nine years was referred by Dr Max Ginsburg on account of a bobby pin lodged in her stomach for four days On Sept 23, 1947 the patient was removed to Childrens Hospital and the alnico magnet introduced into her stomach with fluoroscopic guidance The pin easily attached itself to the magnet and was removed

Case 5 J S, age three years, was referred by Dr Emanuel Friedman for the magnetic removal of a bobby pin which had been lodged in the child's stomach for nine days Repeated X rays had shown that the pin had not succeeded in passing the pylorus (see Fig 6) She was removed to Childrens Hospital on Dec 6 1947 the alnico magnet was passed into her stomach under fluoroscopic guidance and the bobby pin promptly extracted

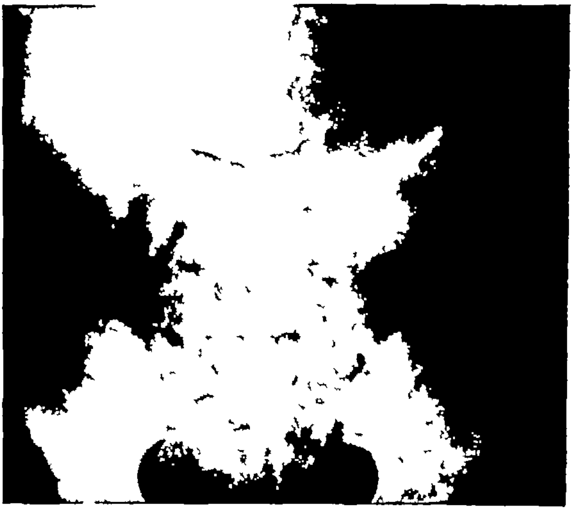


Fig 6 Bobby pin in the stomach of a three-year-old child nine days after it had been swallowed The patient was given a Seidlitz powder in order to distend the stomach with gas as it could not otherwise be definitely determined that the bobby pin was actually in the stomach and not in a coil of intestine Note that the pronged end of the pin is caught in the pyloric ring (Case 5)

CONCLUSIONS

1 The alnico magnet is a useful addition to the endoscopist's armamentarium as an aid in the removal of magnetizable foreign bodies

2 It is a simple, safe instrument and its use is relatively free from danger

3 The alnico magnet may render great assistance in the extraction of open safety pins from the esophagus and stomach, and straight pins from the periphery of the lung

4 Fluoroscopic aid plays an essential part in the manipulation of the alnico magnet

REFERENCES

1 Silber Samuel, Kaplan, Carl, and Epstein, Bernard The Use of a Permanent (Alnico) Magnet in the Peroral Removal of a Metallic Foreign Body (Padlock) from the Stomach *Ann Otol, Rhinol and Laryngol*, 53 589, Sept, 1944

2 Equen Murdock The Alnico Magnet—an Aid to Bronchoscopy and Esophagoscopy *Ann Otol, Rhinol and Laryngol*, 54 178 Mar, 1945

3 Equen Murdock A New Magnet for Foreign Bodies in the Food and Air Passages *Jour A M A*, 127 87, Jan, 1945

4 Jackson, C, and Jackson, C L Bronchoscopy Esophagoscopy and Gastroscopy Philadelphia W B Saunders Co, 1934 p 247

5 *Idem,* p 230

227 Sixteenth Street

INTERNATIONAL CONGRESS OF OTOLARYNGOLOGY, LONDON, 1949

The British Association of Otolaryngologists is organizing the Fourth International Congress of Otolaryngology, to be held in London from July 17 to July 23, 1949 There will be further meetings, for those who wish to go, at Oxford, Cambridge and Edinburgh on July 25 and 26 It is hoped that a full academic program will be arranged, and also various social functions

The secretaries of the National Otolaryngological Societies have been circularized and asked to send a list of their members for individual notification Should any association not receive this letter, they should communicate with the General Secretary, F C W Capps, F R C S, 45, Lincoln's Inn Fields, London, W C 2

BIFID EPIGLOTTIS REPORT OF A CASE*

FERNAND MONTREUIL, M D ,
New York, N Y

Malformations of the larynx are very rare and among these the more frequent ones are those of the epiglottis (Beck and Schneider[1])

Apart from the anomalies in shape, such as the exaggerated infantile type and the broad based flaccid epiglottis, there are only two other malformations reported the bifid epiglottis and absence of the epiglottis

In the case of bifid epiglottis the organ is split in midline to a lesser or greater degree, from a mere indentation of the free border to that of a complete split extending down to the petiolus In some of these cases the splitting of the cartilage would be more extensive on anatomical examination than it would appear on clinical examination Bifid epiglottis is of frequent occurrence only if one includes small indentations of its free border (Weingaertner[2])

To the 16 cases found in the literature (Manifold,[3] Mackenzie,[4] Schreiber,[5] Calmann,[6] Refslund,[7] Henke,[8] Weingaertner,[2] Culp,[9] Jackson[10]), the report of an additional case seems to be of interest

CASE REPORT

On Feb 5 1947, K P a baby girl was admitted to the Babies' Hospital at the age of six weeks, with the complaint of persisting respiratory stridor and dyspnea

Family History Mother, 25 and father, 28, are both in excellent health neither one presents any malformation, nor is there any malformation known to have existed in either family for three generations Examina

---

*From the Department of Otolaryngology of the Columbia University College of Physicians and Surgeons and the Presbyterian Hospital The author was assisted by a grant from the Hayden-Coakley Fund

Editor's Note This ms received in Laryngoscope Office and accepted for publication Dec. 24 1948

tion of the larynx of both the father and the mother proved to be essentially normal

Physical Examination on Admission Fairly well developed and nourished white, one-month premature female baby with slight inspiratory stridor and retraction of the suprasternal spaces The baby has a good cry and is alert

The general physical examination is negative except for an extra digit on each hand (ulnar) and foot

Laboratory findings including X rays of the esophagus were all essentially normal

On Feb 11, 1947, because of continued respiratory difficulty, a tracheotomy was performed under local anesthesia Except for a slight rise in temperature which lasted two days the postoperative course was uneventful Shortly afterwards a direct laryngoscopy showed that the epiglottis

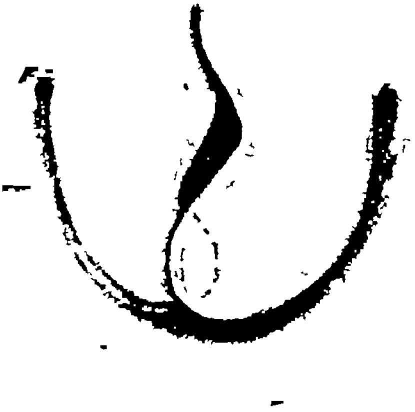


Fig 1 Drawing of the epiglottis as seen through direct laryngoscopy The laryngeal chink and most of the aryepiglottic folds are masked by the overlying epiglottic halves Note the left epiglottic half which lies on a deeper plane and whose tip is partly covered by the right half

was completely split in midline from its free edge down to its base, forming two equal parts Both halves appeared to be very lax The left half was seen to lie deeper than the right one and the tip of the left half was somewhat obscured by the overriding right half (see Fig 1) On inspiration both halves of the epiglottis and the aryepiglottic folds were seen to be sucked into the glottic chink The glottic chink appeared to be reduced in size and a No 16 bougie could not be passed Subsequent laryngoscopies showed essentially the same picture, and little if any stiffening of the epiglottis could be noted

It was at first thought that age might remedy this laxness and that the epiglottis might regain some of its tonicity After observing the baby for some nine months, it became evident that such would not be the case, and it was, therefore, decided to amputate the epiglottis

On Dec 16, 1947, under general ether anesthesia the epiglottis was exposed by suspension laryngoscopy and both halves of the epiglottis were amputated near the base Following operation, there appeared to be an increase in the amount of secretions, but no postoperative bleeding was encountered — swallowing was essentially normal On Dec 24, 1947, the tracheotomy was half corked, and on Jan 10 1948 was fully corked On Jan 19, 1948 the tracheotomy tube was removed and tracheotomy was allowed to close

Laryngoscopy on Jan 9, 1948 revealed a well healed epiglottic stump which now was not sucked in with inspiration On Jan 26, 1948 the baby was discharged from the hospital and has remained well ever since The baby was last seen and laryngoscoped in May at which time no change was noted The tracheostomy has closed over leaving a fairly large scar which it is intended to remove by plastic repair at a later date

Among the 16 cases reported in the literature, there are few with a complete splitting of the epiglottis Only two cases are described in any detail

Weingaertner,[2] in 1920, describes the case of an adult on whom a mirror examination revealed a split of the epiglottis extending from its free border to its inferior third The inferior third or base of the epiglottis apparently presented a split cartilage whose halves were covered over by normal mucosa It is interesting to note that this patient also presented an extra digit on each hand and foot In his case report, Weingaertner states that only three other cases are to be found in literature He mentions Henke's four cases, but somehow fails to include them, and, as for Schreiber's case which he also mentions, he omits it on the grounds that his description is not too clear, and Weingaertner refused to recognize it as a case of bifid epiglottis On reviewing Schreiber's[5] case, however, it appears unquestionably to be one of bifid epiglottis

Of Henke's[8] eight cases, four were admittedly marginal defects and are not counted, and of the remaining four cases, only in two was the split seen to extend down to the base

The only case examined histologically is one reported by Culp[9] Here the bifid epiglottis was an accidental postmortem finding in a one-and-one-half-year-old baby girl On macroscopic examination the epiglottis was split for a distance of

4 mm from its free border On histological examination, however, the cartilage was found to be split for a greater distance and extended down to its base The two halves of cartilage at the base were united by dense connective tissue Each half presented two separate chondrification centers

Schreiber's[5] case, contrary to Weingaertner's opinion, is thought to represent a case of bifid epiglottis

Refslund's[7] case can hardly be called a bifid epiglottis, as apparently only the cartilage was split and not the covering mucosa

Calmann's[6] case not only presented one midline split, but three, thus dividing the epiglottis into four parts

Manifold and Mackenzie's original articles were not to be found in New York or the Surgeon General's Library

The explanation of this malformation is not easy, mainly because of the fact that there is no unanimity among the authors concerning the development of the epiglottis

The first appearance of the larynx is found in 6 mm embryos (25 to 26 days) (Soulie and Bardier,[11] J E Frazer[12]) At this time the respiratory groove is transformed into the laryngotracheal duct by lateral mesenchymal ingrowths At this stage also appears a large medial swelling on the anterior wall of the duct, the so-called furcula of His All authors agree that the furcula of His takes part in the formation of the epiglottis through its posterior portion and in the formation of the tongue through its anterior portion Two points are controversial, however whether the furcula is of bilateral origin or not, and whether the furcula is the sole anlage of the epiglottis

According to Frazer,[12] whose work is about the most recent on the subject, the epiglottis is derived solely from the furcula, which is, from the very beginning, of impaired and medial origin, the fourth branchial arches playing no part in the formation of the epiglottis and only participating in the formation of the aryepiglottic folds

On the other hand, Soulie and Bardier concluded that the furcula had a bilateral origin These authors noted in very young embryos (6 and 7 mm) that as soon as the furcula made its appearance, this swelling always presented a small indentation of both its superior and inferior borders, thus attesting to a bilateral origin

Roth,[13] studying older embryos, came to the conclusion that the epiglottis had both a medial and a bilateral origin, because on his embryos he found a small groove just off midline on both sides, which grooves divided the swelling into three distinct parts, one medial and two lateral This theory would render the explanation of the case described by Calmann much easier

Kallius,[14] noting the same findings, explained that the medial portion only contained cartilage and developed into the epiglottis, whereas the lateral portions, devoid of cartilage, gave rise to the aryepiglottic folds

Soulie and Bardier[11] explain this medial portion as the resultant of the fusion, in midline, of the two lateral portions

A bifid epiglottis could easily be explained by assuming a bilateral anlage of the furcula, either through absence or incomplete fusion of the lateral masses To a certain extent these cases of bifid epiglottis could be used as an indirect proof for the assumption of a bilateral origin of the epiglottis Additional proof can be gained by the fact that in certain animals a bifid epiglottis is known to exist, such as in the sea-lion (Negus[5]) In Echidna, the epiglottis, although not showing any visible split, contains, nevertheless, two separate halves of cartilage which are united in midline by dense connective tissue (Negus)

The final answer to this question will have to be found in further studies on the subject of the development of the epiglottis

SUMMARY

A case of bifid epiglottis is reported, in which both halves were very flaccid and caused laryngeal obstruction which necessitated a tracheotomy, and later on, amputation of the epiglottis Sixteen cases are mentioned in the literature Eleven of these cases are not considered to represent true bifid epiglottis

The embryology of the epiglottis is discussed in an attempt to explain this malformation and the assumption of a bilateral eral origin of the epiglottis with absence or incomplete fusion between the two parts most easily explain the bifid epiglottis

REFERENCES

1 Beck and Schneider In Denker A and Kahler O *Handb der Hals Nasen-Ohrenheilk* Berlin Julius Springer 2 425 1928

2 Weingaertner, M Beitrag zu den angeborenen Missbildungen des Kehlkopfes *Arch f Laryngol u Rhinol.,* 33 718 1920

3 Manifold Quoted by Culp [9]

4 Mackenzie, M *Trans Path Soc London* 25 35 1874

5 Schreiber *Berl Klin Wchnschr*, 25 694 1888

6 Calmann, A. Missbilungen an Zunge und Kehlkopf Inaug Diss Berlin 1893

7 Refslund, H Ueber Respirationsstorungen infolge von Missbildung der Epiglottis Inaug Diss, Kiel 1896

8 Henke, R Zur Morphologie der Epiglottis *Monatsschr f Ohrenheilk u Laryngol u Rhinol*, 33 279 1899

9 Culp, W Uber mediane vollkommene Spaltung der Epiglottis *Frankfurter Ztschr f Path.,* 24 177 1920

10 Jackson C L Personal communication to the author

11 Soulie and Bardier Recherches sur le developpement du larynx chez l'homme *Jour d anat et physiol*, 43 137 1907

12 Frazer, J E Development of the Larynx *Jour Anat and Physiol* 44 156 1909

13 Roth, W Der Kehldeckel und die Stimmritze im Embryo nebst einigen Bemerkungen uber die Entwickelung der Schleimdrusen Hittheil aus dem embryol Instit der K. K. Universit. von Schenk, Wien p 145 1878

14 Kallius E Beitrage zur Entwickelungsgeschichte des Kehlkopfes 4 tof Anatomische Hefte, Bd 9 Festschrift von Fr Merkel Weisbaden, p 301 1897

Kallius, E Die Entwickelung des menschliden Kehlkopfes *Verhandl Anat Gesellsch*, Kiel p 240 1898

15 Negus, V E The Mechanism of the Larynx St. Louis C V Mosby Co p 43 1929

FENESTRATION OF THE LABYRINTH *

A Bibliography as of Dec 31, 1946 †

Additions Up to the Closing Date of the Original Bibliography

George Kelemen, M D,
Boston, Mass

Babbitt James A Discussion to Campbell *Trans Amer Ac Ophth and Otolaryngol*, 44 300-301, 1939

Barany, Robert Versuche über die Wirkung des künstlichen Trommelfelles und ihre Erklärung *Verh deutsche otol Ges*, 19 81 89, 1910

Campbell, A, De Villiers, A J and Kerr, W A Fenestration for Otosclerosis *S African Med Jour*, 21 252 254 May 11, 1946

Carruthers, D G Surgical Treatment of Deafness, Fenestration Operation for Otosclerosis *Med Jour Australia*, 2 669 670, Nov 9 1946

De Villiers, A J See Campbell De Villiers and Kerr

Duerto, J See original Bibliography, also, *Rev Espanola y Americana de Laringologia*, 21 241 245 1930

Dundas Grant, James Discussion to Kisch, *Proc Roy Soc Med*, 6 1912, Sec Otol, 37

Dundas Grant, James Discussion to Sourdille *Proc Roy Soc Med*, 23 1455, Aug, 1930

Fine, J What Is New in Otosclerosis? *S African Med Jour*, 20 748 749, 1946

Flake, Carlyle G Medical Progress — Otolaryngology *N Eng Jour Med*, 235 684 691, Nov 7, 1946

Fox, G M Fenestration for Otosclerosis *S African Med Jour*, 20 479 481 Aug 24 1946

German Tibor On Fenestration of the Labyrinth (in Hungarian) *Orvostudomanyi Kozlemenyek*, 16 441 447 1941

Gibb Aldington Discussion to Sourdille, *Proc Roy Soc Med* 23 1455 Aug, 1930

Hall, I Simson The Surgical Treatment of Deafness *Irish Jour Med Sci*, pp 80 84 Mar 1946

Hall I Simson The Fenestration Operation for Otosclerosis *Brit Med Jour* 2 647 649, Nov 2, 1946

Henriot H See Le Mee and Henriot

Holmgren, Gunnar Problem of Otosclerosis *Nord Med* 25 287 290 Feb 16 1945

---

*From the Department of Otolaryngology the Massachusetts Eye and Ear Infirmary

†The Laryngoscope 58 74-85 Jan 1948

Editor's Note This ms received in Laryngoscope Office and accepted for publication Nov 22 1948

HOUSE, HOWARD P Indications for the Fenestration Operation *Trans Amer Laryngol, Rhinol and Otol Soc* 50 305-312, 1946

JACK, FREDERICK L Remarks on Stapedectomy *Trans Amer Otol Soc* 6 102 106, 1897

JENKINS, J G Discussion to Kisch, *Proc Roy Soc Med*, 6 1912 Sec Otol, 37

JENKINS, J G Discussion to Sourdille, *Proc Roy Soc Med*, 23 1453, Aug, 1930

KERR, W A. See Campbell, De Villiers and Kerr

KINNEY, CHARLES E Discussion to House *Trans Amer Laryngol, Rhinol and Otol Soc*, 50 313, 1946

KISCH, HAROLD A Two Cases of Operation for Chronic Adhesive Catarrh of the Middle Ear (Tympanoplasty) *Proc Roy Soc Med*, 6 1912, Sec Otol., 36

KISCH, HAROLD A. Discussion to Sourdille *Proc Roy Soc Med*, 23 1454, Aug 1930

LAKE RICHARD Discussion to Kisch, *Proc Roy Soc Med* 6 1912 Sec Otol 37

LE MEE, J M and HENRIOT, H La fénestration opération de Lempert, thérapeutique chirurgicale de la surdité progressive *La Presse Med*, 54 797 Nov 30 1946

LEMPERT JULIUS Discussion to Campbell, *Trans Amer Ac Ophth and Otolaryngol*, 44 301-303, 1939

MAXWELL, J H Discussion to Spake *Trans Amer Laryngol, Rhinol and Otol Soc*, 50 303, 1946

MCKENZIE, DAN Discussion to Sourdille *Proc Roy Soc Med* 23 1453, Aug 1930

MOLLISON, W M Discussion to Kisch *Proc Roy Soc Med* 6 1912, Sec Otol, 37

MUECKE Discussion to Kisch, *Proc Roy Soc Med*, 6 1912, Sec Otol 37

OMBREDANNE, MARCEL Les imperforations du conduit auditif externe *L'oto rhino-laryngol* (Lyon) 31 249 255, Nov 1943

OMBREDANNE MARCEL Les imperforations du conduit auditif externe avec aplasie du pavillon *La Presse Med*, 52 131-142 May 6, 1944

OMBREDANNE MARCEL Nouveaux cas d'imperforation du conduit auditif externe avec aplasie du pavillon Résultat opératoire *Arch Franc Pediat*, 2 73 74 1944

OMBREDANNE, MARCEL Les imperforations du conduit auditif externe en corrélation avec les malformations congénitales du pavillon *Ann d Oto-Laryngol*, pp 1 5 Jan Mar 1944

POPPER O Fenestration for Otosclerosis *S African Med Jour* 20 286 May 25 1946

POPPER, O Fenestration of the Labyrinth Part II *Jour Laryngol and Otol*, 61 441-458 Aug 1946

PORTA CARLO FELICE Contributo alla terapia chirurgica dell'otosclerosi *Atti d R Accad dei Fisiocritici e Studi d Facolta med Senese*, 8 Ser XI, 215 1940

PORTMANN GEORGES Le traitment de la surdité progressive par l'opération de la fenestration de Lempert *La Presse Med*, 54 301-302 May 11 1946

Pritchard Urban Discussion to Kisch, *Proc Roy Soc Med*, 6 1912, Sec Otol 37

Rosenberger, H C Discussion to Spake *Trans Amer Laryngol, Rhinol and Otol Soc*, 50 304, 1946

Shambaugh, George E Jr Results of the Fenestration Operation for the Surgical Treatment of Deafness *Kansas City Med Jour*, 22 18 21, Mar Apr, 1946

Sourdille, Maurice Techniques chirurgicales nouvelles pour le traitement des surdités de conduction *Bull Acad med Paris*, 102 674 678 Dec 17 ,1929

Sourdille, Maurice Sur le traitement chirurgical de l'otosclerose *Rev de laryngol, d'otol, et de rhinol*, 51 342-353 May, 1930

Sourdille, Maurice Surgical Treatment of Otosclerosis *Jour Laryngol and Otol*, 45 601 614, Sept, 1930

Sourdille, Maurice Nouvelles techniques chirurgicales pour le traitement des surdités de conduction *Ann mal de l'oreille*, 49 10 21 1930

Spake, La Verne B The End Results in the Lempert Fenestration for Clinical Otosclerosis (with Special Reference to the Mobile Stopple) *Trans Amer Laryngol, Rhinol and Otol Soc*, 50 293 304 1946

Tezel, E B Surgical Treatment of Otosclerosis *Turk tip cem mec*, 12 364 376, 1946

Walsh Theo E Discussion to Spake, *Trans Amer Laryngol, Rhinol and Otol Soc*, 50 299, 1946

Williams, Henry L Selection of Cases for the Fenestration Operation in Otosclerosis *Cent Illinois Soc Ophth and Otolaryngol*, 4, Apr 27 1946

Williams, Henry L Selection of the Patient for the Fenestration Operation for Otosclerosis *S Clin N Amer*, 26 876 889, Aug, 1946

Williams, Henry L Discussion to Spake, *Trans Amer Laryngol, Rhinol and Otol Soc*, 50 310 1946

Wilson T G The Surgical Treatment of Deafness *Irish Jour Med Sci*, 6 33-37, 1946

Worral, J D Surgical Treatment of Deafness *McGregor Clin Bull*, 7 11, Dec 1946

BOOK REVIEW

Phylogenesis of the Ear By Louis Guggenheim, M D Associate Professor of Otolaryngology ,University of Southern California formerly Assistant Professor of Otolaryngology Washington University School of Medicine St Louis formerly Research Associate University of California Los Angeles Fellow of the American Medical Association American College of Surgeons American Otological Society American Laryngological Rhinological and Otological Society Inc., American Academy of Ophthalmology and Otolaryngology, etc Two hundred seventy-one pages and Index with 196 illustrations Culver City, Calif Murray & Gee Inc , 1948 Price $12 50

Dr Guggenheim s interest in the comparative aspects of the ear is to be highly commended There are certainly few otologists who would undertake a similar task.

It is unfortunate that the book is too superficial in its scope to be of much if any scientific value This is apparently not the purpose for which it is intended because in the Foreword it is mentioned that its contents are primarily dedicated to the otologist. Aside from the fact that the book is pleasant reading it lacks in detailed information and cannot be considered as a valuable reference book.

The first half of the book is devoted to the phylogenetic development of the ear in invertebrates It is apparent that standard elementary text books of zoology and comparative biology have furnished the chief sources of information for these chapters Whole phyla are disposed of in one or two paragraphs although further detail must exist in the literature On page 51 there are three phyla discussed

There should have been some attempt made to consider the extensive literature which exists on the balancing mechanisms in lower forms He attributes the efficiency of the balancing mechanism in protozoa to protoplasmic density, which is certainly not the case

A considerable amount of the 277 pages is given up to illustrations Many of these are good but there are also poor ones The photomicrographs in several instances are indistinct The descriptions accompanying the illustrations are sometimes incomplete For example in showing a rat embryo section it is labeled comparable to a human embryo of two and a half months Although the text mentions the age of the rat embryo it is not included with the illustration.

The large type and number of illustrations make the text extremely easy to read.

W P C

MISSISSIPPI VALLEY MEDICAL SOCIETY
1949 ESSAY CONTEST

The Ninth Annual Essay Contest of the Mississippi Valley Medical Society will be held in 1949 The Society will offer a cash prize of $100 00, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics and education) and practical value to the general practitioner of medicine Certificates of merit may also be granted to the physicians whose essays are rated second and third best Contestants must be members of the American Medical Association who are residents and citizens of the United States The winner will be invited to present his contribution before the Fourteenth Annual Meeting of the Mississippi Valley Medical Society to be held in St Louis, Mo, Sept 28, 29, 30, 1949, the Society reserving the exclusive right to first publish the essay in its official publication — the *Mississippi Valley Medical Journal* (incorporating the *Radiologic Review*) All contributions shall be typewritten in English in manuscript form, submitted in five copies, not to exceed 5,000 words, and must be received not later than May 1, 1949 The winning essays in the 1948 contest appear in the January, 1949, issue of the *Mississippi Valley Medical Journal* (Quincy, Ill)

Further details may be secured from Dr Harold Swanberg, Secretary, Mississippi Valley Medical Society, 209-224 W U U Building, Quincy, Ill

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

The annual meetings of the Triological Society and the Broncho-Esophagological Association will be held concurrently at the Drake in Chicago on April 18, 19 and 20, 1949 A joint meeting of these two societies will take place Tuesday morning, April 19 On the other days the Triological Society will meet in the mornings and the Bronchoscopic Society in the afternoons

We also call your attention to these dates and places

American Board of Otolaryngology—May 11-14, 1949, New York City

American Laryngological Association — May 16-17, 1949, New York City

American Otological Society—May 18-19, 1949, New York City

In order to facilitate the coordination of national meetings, the Bronchoscopic, the Otological, the Laryngological and the Triological Societies are considering a five-year plan of dates and places By adoption of such a scheme we hope to reduce the traveling mileage and the amount of time away from our offices For additional information, write to Dr C Stewart Nash, Secretary, 708 Medical Arts Building, Rochester 7, N Y

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp, 580 Fifth Ave New York 19, N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St., Chicago, Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St, Chicago, Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co, Inc, 10 East 43rd St, New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc, 50 W 29th St, New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co, Inc, North Third St., Minneapolis, Minn

1947—Mears Aurophone Model 98, Mears Aurophone Model 200

Manufacturer Mears Radio Hearing Device Corp, 1 W 34th St, New York, N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co, 727 Atlantic Ave, Boston 11 Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co 4602 Nicollet Ave, Minneapolis 9, Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories, 815 S Hill St Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2

Manufacturer Otarion Hearing Aids, 159 N Dearborn St., Chicago, Ill

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS

Manufacturer Paraphone Hearing Aid, Inc 2056 E 4th St., Cleveland, Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale, Chicago 14, Ill

Radioear Masterpiece, Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone

Manufacturer E A Myers & Sons, 306 Beverly Rd, Mt Lebanon Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp 6001 W Dickens Ave, Chicago, Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp 101 Tremont St, Boston 8, Mass

Solopak Hearing Aids

Manufacturer Allen Howe Electronics Corp, 150 Main St., Peabody, Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp, Elmsford N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc, 2454 S Michigan Ave, Chicago, Ill

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex Inc Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc, 1627 Pacific Ave Dallas 1, Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm, Inc 400 W Lake St, Libertyville, Ill

Unex Model "A"

Manufacturer Nichols & Clark, Hathorne, Mass

Vactuphone Model 3

Manufacturer Allen Howe Electronics Corp, Salem, Mass

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc, 120 Broadway New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave Chicago Ill

All of the accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Marvin F Jones 121 E 60th St New York 22 N Y
Secretary Dr Gordon D Hoople, Medical Arts Bldg Syracuse 3 N Y
Meeting New York, N Y May 18 19, 1949

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Frederick T Hill, Professional Bldg, Waterville Me
Secretary Louis H. Clerf, 1530 Locust St. Philadelphia 2, Pa.
Meeting New York N Y May 16-17 1949

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr John J Shea, 1018 Madison Ave, Memphis, Tenn.
Secretary Dr C Stewart Nash 708 Medical Arts Building Rochester, N Y
Annual Meeting Chicago Ill Hotel Drake April 18 20, 1949

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St., Charlottesville, Va.
Secretary Dr James M. Robb 641 David Whitney Bldg, Detroit, Mich.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens 35 E 70th St. New York, N Y
President Elect Dr J Mackenzie Brown 1136 W 6th St. Los Angeles Calif.
Executive Secretary Dr William L Benedict Mayo Clinic Rochester, Minn

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley 384 Post St. San Francisco Calif
Secretary Treasurer Dr Joseph Hampsey, 806 May Bldg, Pittsburgh 22 Pa

AMERICAN BOARD OF OTOLARYNGOLOGY

Meeting New York, N Y, May 11 14, 1949

PAN AMERICAN ASSOCIATION OF OTO RHINO LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L Jackson, 255 S 17th St., Philadelphia, Pa

Second Pan American Congress of Oto Rhino Laryngology and Broncho-Esophagology Montevideo, January, 1950

AMERICAN BRONCHO ESOPHAGOLOGICAL ASSOCIATION

President Dr Paul Holinger, 700 N Michigan Ave, Chicago 11, Ill

Secretary Dr Edwin N Broyles, 1100 N Charles St Baltimore 1 Md

Meeting Chicago Ill, April 18 20, 1949

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Colby Hall

Secretary Treasurer Dr Warren A Wilson

Chairman of Section on Ophthalmology Dr John A Bullis

Secretary of Section on Ophthalmology Dr Rodman Irvine

Chairman of Section on Otolaryngology Dr Leland G Hunnicutt

Secretary of Section on Otolaryngology Dr Alden H Miller

Place Los Angeles County Medical Association Bldg 1925 Wilshire Blvd, Los Angeles, Calif

Time 6 P M, fourth Monday of each month from September to May, inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner, 115 E 61st Street, New York 21, N Y

Secretary Dr Norman N Smith, 291 Whitney Avenue, New Haven 11, Conn

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave, North Nashville 3, Tenn

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg, Atlanta 3, Ga

Vice Chairman Dr V R Hurst 315 N Center St., Longview, Tex

Secretary Dr Alston Callahan, 908 S Twentieth St., Birmingham 5, Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M. Valentine Miller 114 W Phil Ellen St. Philadelphia Pa

Vice-President Dr Thomas F Furlong Jr 36 Parking Plaza Ardmore Pa.

Treasurer Dr Harry P Schenck 1912 Spruce St. Philadelphia Pa

Secretary Dr William J Hitschler 5 E Chestnut Hill Ave Philadelphia 18 Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Vicente Banet.

Vice-Presidente Dr José Lastra.

Secretario Dr René Smith

Vice-Secretario Dr Luis Rodriguez Baz

Tesorero Dr Antonio Rodrigues Diaz

Vice-Tesorero Dr Tomás Armstrong

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier

First Secretary Dr Gabriel Porto

Second Secretary Dr Roberto Barbosa

Librarian Treasurer Dr Leoncio de Souza Queiroz

Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino

Vice-Presidente Dr Luis E Olsen.

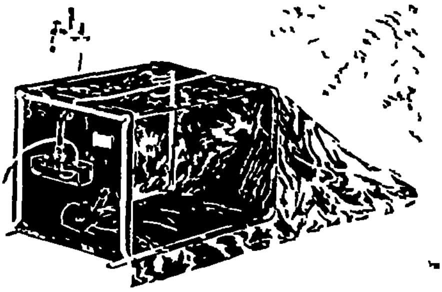
Secretario Dr Eugenio Romero Diaz.

Tesorero Dr Juan Manuel Pradales

Vocales Dr Osvaldo Suárez Dr Nondier Asís R., Dr Jorge Bergallo Yofre.

THE CROUPETTE*

HUMIDITY TENT



An entirely new humidification unit for use in treatment of respiratory ailments where high relative humidity is indicated It provides for the patient a nearly invisible, cool nebulized spray with minimum condensation

A practical substitute for special steam or vapor rooms and cumbersome mechanical apparatus Children are afforded excellent visibility through the transparent canopy and wear normal clothing and bedding Nurses work in normal room temperature

OUTSTANDING FEATURES

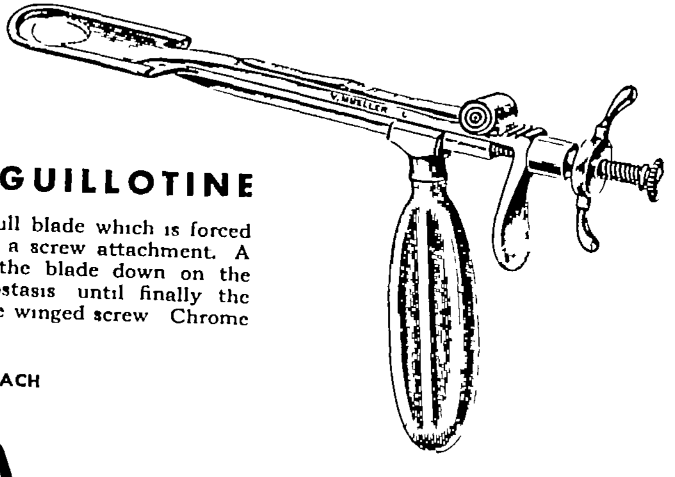
- Humidity from 85% to 95% with minimum condensation Water tank holds an 18 hour supply of water
- If operated with oxygen concentrations from 30% to 50% can be maintained at a fixed flow of 1 to 5 liter per min A special motor compressor is available for operation of the Croupette without oxygen A nebulizer for aerosol therapy is also available
- Adjustable for use on any standard size crib or bed Folds flat for storage Weighs 11 lb
- No mechanical parts to get out of order or create hazard

- Detailed information and name of Authorized Dealers may be obtained directly from Air Shields Inc

AIR-SHIELDS, INC. • HATBORO, PA.

Trade Mark Manufacturers of the ISOLETTE Infant Incubator

Pre-War Quality
AGAIN!



SLUDER-SAUER GUILLOTINE

An effective guillotine with a dull blade which is forced through the tissue by means of a screw attachment. A spring ratchet permits closing the blade down on the tonsil by slow stages for hemostasis until finally the tonsil is severed by means of the winged screw Chrome plated

$36.00 EACH

ORDER DIRECT FROM

V. Mueller and Company

408 S HONORE STREET
CHICAGO 12, ILLLINOIS

THE
LARYNGOSCOPE.

VOL LIX MARCH, 1949 NO 3

HYDROPS OF THE LABYRINTH CASE REPORT COAGULATION OPERATION, CLINICAL COURSE AND HISTOPATHOLOGY

KENNETH M DAY, M D,* Pittsburgh, Pa, and
JOHN R LINDSAY, M D,† Chicago, Ill

A white male, age 56, was admitted to Pittsburgh Eye and Ear Hospital, March 4, 1942, with a history of repeated paroxysmal attacks of vertigo during the past eight years, associated with a low-pitched roaring tinnitus and gradually increasing deafness in the right ear The vertigo attacks were described as a feeling of objects rotating from right to left when upright When lying down, the foot of the bed seemed to drop and objects whirled forward over his head The duration of the attacks varied from a few minutes to over an hour and were usually accompanied by nausea, vomiting and prostration The most recent attack occurred a week before admission while the patient was driving a car, causing him to drive off the road and wreck the car Between the acute attacks of vertigo he frequently felt dizzy and unsteady, and the roaring tinnitus in his right ear was constantly present He had been under treatment by several doctors during the previous three years Treatment included ammonium chloride and salt-free diet, also nicotinic acid He had received no relief from treatment and was desperate His past medical history was not

---

*University of Pittsburgh.

†Division of Otolaryngology the University of Chicago

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 14 1949

significant except for a tendency to high blood pressure for the past five years

On local physical examination the nose and throat were negative The eardrums were in good position and rather opaque There were no scars visible Marked diminution of hearing in the right ear He could not hear a C-4 fork in the right ear Rinne was positive and the Weber test lateralized to the left ear No spontaneous nystagmus Caloric test showed only slightest response from the vertical canals, moderate reaction from the horizontal canals after douching for one minute with water at 52° F X-rays showed pneumatic mastoids

General physical and neurologic examinations were negative except for moderate hypertension and arteriosclerosis B P, 158/90 Heart slightly enlarged, with some mitral insufficiency

A diagnosis was made of Meniere's disease or hydrops of the right labyrinth

Operation March 6, 1942 Through a postauricular incision the mastoid cortex was exposed and the antrum opened by means of drills The opening into the antrum was enlarged and the outer wall of the aditus removed, thus exposing the incus The horizontal canal was then skeletonized A window was made into the horizontal semicircular canal medial to the short process of the incus The endosteum was removed and the membranous canal could be visualized but did not seem to be distended A fine needle was passed through the opening in the canal forward into the vestibule Three applications of a mild coagulating current, of about one-half second each, were then made to the needle A strong facial spasm occurred with each application The needle was withdrawn and the mastoid cavity allowed to fill with blood The incision was closed with clips

Postoperative convalescence was rapid The patient was able to sit up and eat the next day Vertigo was moderate and noticeable only on moving the head On the fourth day the patient was able to get out of bed A spontaneous rotary nystagmus was seen when looking to the left, but was not apparent when the eyes were turned to the right or straight ahead The roaring tinnitus was still present but was not as loud as before operation The patient claimed he could hear a radio with his right ear when he stopped his left with his finger Ten days following operation the patient was walking without assistance There was some unsteadiness The wound was healed and the dressing discarded He was discharged on the eleventh day

One month following operation he reported that he was free of dizziness Some difficulty finding his way in the dark The roaring tinnitus was still present but not nearly so loud as before operation Hearing in the operated ear was improving, though sounds seemed somewhat "fuzzy" in that ear

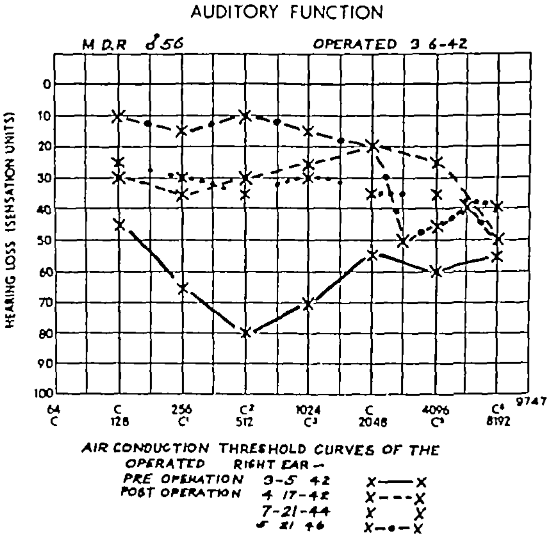
Six months following operation the patient was seen again He felt fine, was free of dizziness and had gained 20 pounds He no longer had any difficulty getting around at night He claimed to be able to hear "twice as well" as before operation Tinnitus still present, though not constant A caloric test done at this time produced no response from the right ear when douched with water at 46° F for one minute On standing up, the Romberg test was negative Douching the left ear for 10 seconds produced active responses from all canals

During the next four years this patient was seen at irregular intervals and he was twice admitted to the hospital for treatment for arteriosclerotic and hypertensive heart disease with congestive failure On one occasion he reported an objective vertiginous attack lasting 24 hours, accompanied by vomiting, but this was associated with numbness and loss of function of the right side of the body It was diagnosed as cerebral angiospasm and not labyrinthine disease

The last otological examination was made in May, 1946 At that time he still had a blowing, soft tinnitus in the right ear and sounds seemed blurred in that ear, though he claimed that he could use the right ear in telephoning During the next year he developed increasing signs of cardiac decompensation and finally expired in another hospital of congestive failure in August, 1947 The temporal bones were removed within a half hour and were shipped to Dr Lindsay for study

HISTOPATHOLOGICAL EXAMINATION

The temporal bones were received in 20 per cent formalin solution They had been removed and placed in the fixative



AIR CONDUCTION THRESHOLD CURVES OF THE OPERATED RIGHT EAR –

PRE OPERATION 3-5-42 X——X
POST OPERATION 4-17-42 X---X
7-21-44 X X
" 21 46 X–•–X

Fig 1

solution at about four hours after death They were decalcified, imbedded in celloidin, sectioned serially, and every tenth section stained with hematoxylin and eosin

Left Temporal Bone Middle Ear The tympanic membrane and middle ear air spaces and ossicular chain were normal Pneumatization was limited to the mastoid portion

Inner Ear The membranous structures were fairly well preserved The perilymphatic spaces were normal throughout The endolymphatic system also was normal Reissner's membrane was in the normal position, and the saccule, utricle and ampullae of the semicircular canals showed a normal contour throughout An occasional defect in the membranes had occurred during preparation

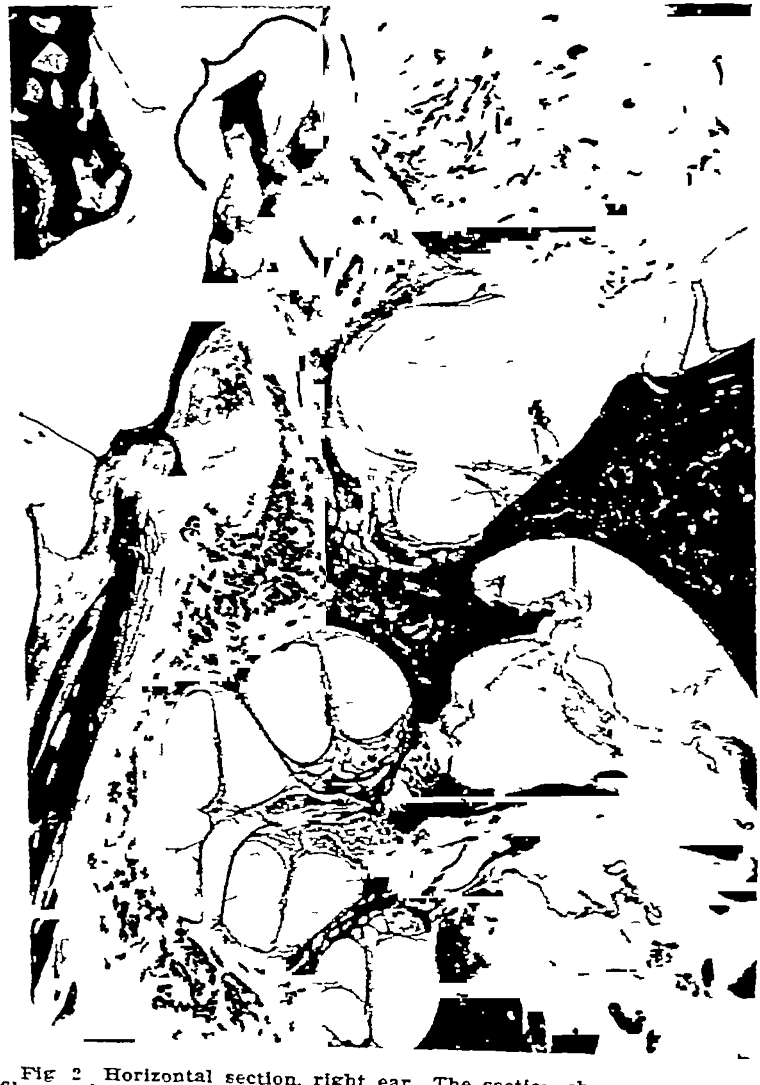


Fig 2 Horizontal section, right ear The section shows new bone and fibrous tissue obliterating the horizontal canal ampulla and utricle The remaining space in the vestibule was occupied by the dilated saccule

The sense organs in the saccule, utricle and ampullae showed no abnormality

The stria vascularis appeared approximately normal

The tectorial membrane was mostly in contact with Corti's organ but was shrunken and thinned out in appearance

Corti's organ also showed evidence of some shrinkage, the pillars distorted slightly as if by pulling towards the spiral lamina The hair cells were well enough preserved to determine their presence and showed no evidence of reduction in number (see Fig 2)

The spiral ganglion showed some reduction in the number of cells in the basal coil

Comment The only abnormality found in the middle or inner ear was a moderate decrease in the number of ganglion cells in the basal coil

Right Temporal Bone Middle Ear The eardrum, middle ear proper and ossicular chain showed no significant abnormality The petrous pyramid was not pneumatized

The mastoid contained a single large cavity lined by fairly thin mucoperiosteum There was very little evidence of new bone having formed along the margins The operative defect had apparently remained its full size and healed without evidence of inflammatory reaction

Inner Ear The endolymphatic spaces showed an advanced degree of dilatation (see Fig 3)

The cochlear duct was dilated to the extent that the vestibular scala was obliterated throughout almost its full extent

The saccule was extensively dilated, with beginning extension into the small end of the horizontal canal The saccular macula showed no definite abnormality

The utricle was almost entirely destroyed and the macula was no longer present The horizontal canal was filled by new bone and fibrous connective tissue from the ampulla to within a short distance of the entrance of the small end of the canal into the vestibule The fibrous tissue, along with some bony trabeculae, extended forward into the vestibule to obliterate the utricular macula and almost all of the space occupied by the utricle A thin layer of fibrous tissue containing bone

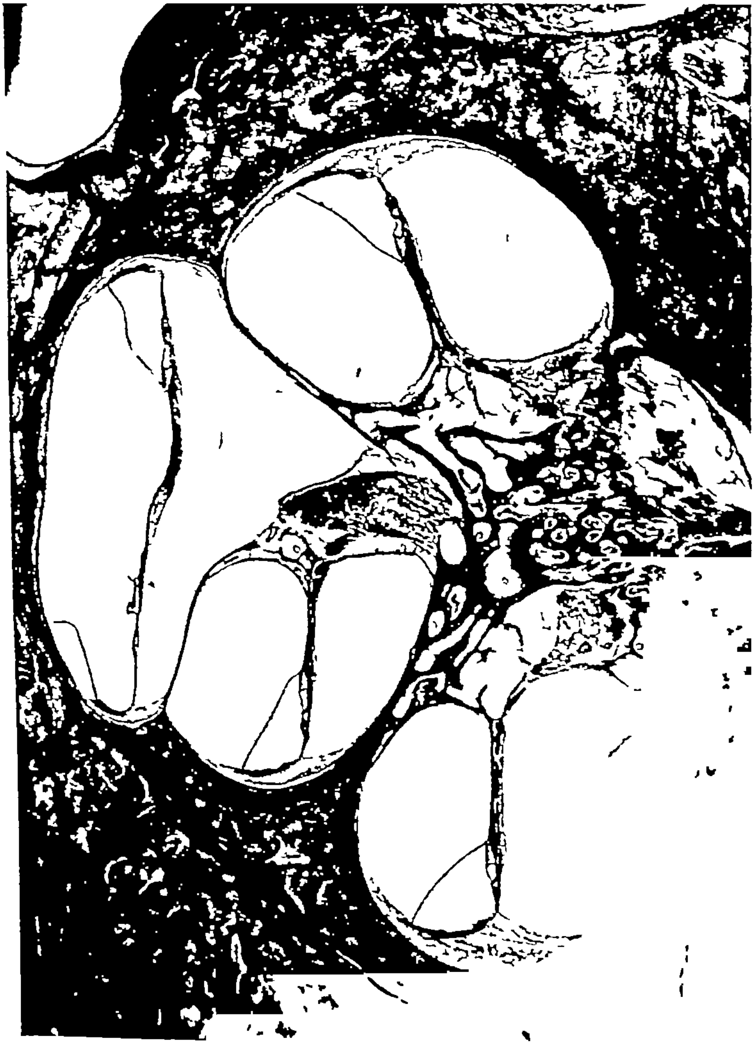


Fig 3 Left cochlea

deposits extended down over the inner surface of the stapes footplate New bone also filled the ampulla of the superior vertical canal and extended upward and around to within a short distance of the common crus The ampulla of the pos-

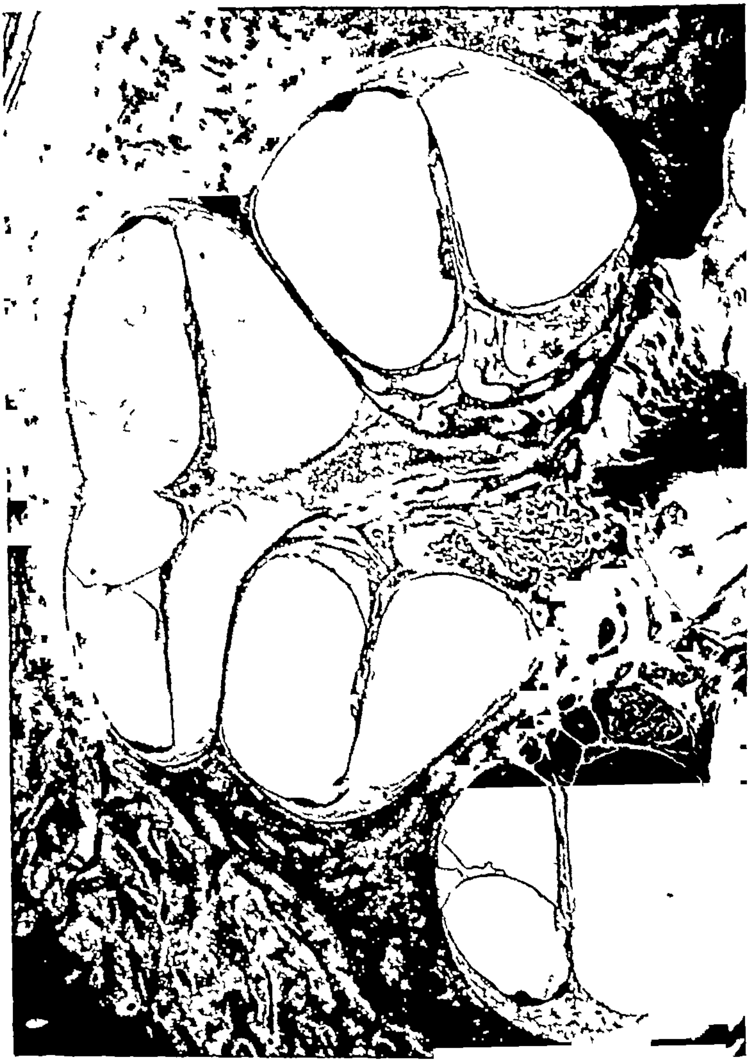


Fig 4 Right cochlea. Midmodiolar section showing extreme dilatation of the cochlear duct moderate atrophy of the stria vascularis and degeneration of ganglion cells and nerve fibres in the basal coil

terior semicircular canal showed distortion of the ampullary wall, but the membranous canal was otherwise normal

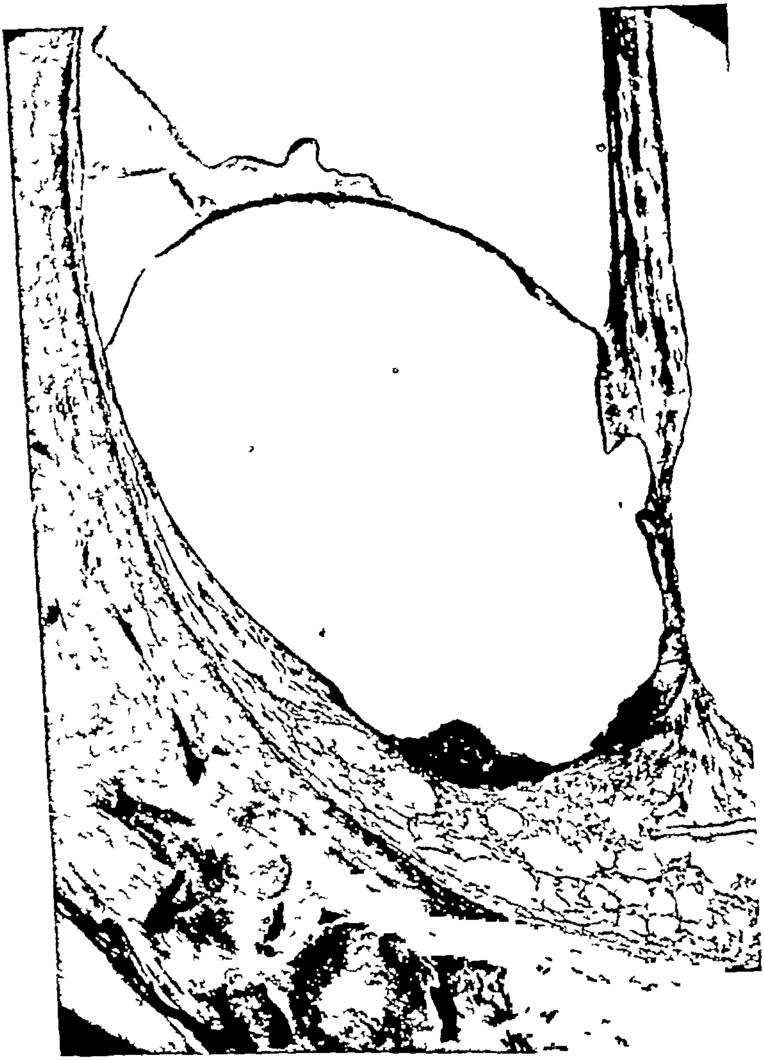


Fig 5 Right cochlea Higher magnification of the dilated cochlear duct in the basal coil showing the atrophied stria vascularis and the degenerated Corti s organ The clear horizontal streak in the central part of Corti s organ represents the tectorial membrane which had apparently become attached and overgrown by cells extending from the lateral margin (cells of Hensen and Claudius)

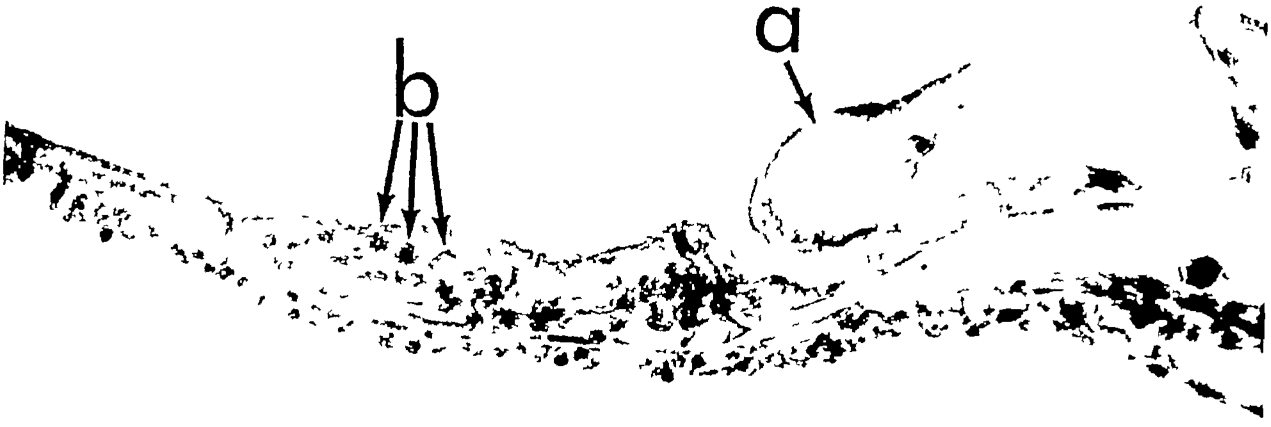


Fig 6 Corti's organ at the midpoint of the middle coil of the right cochlea The tectorial membrane (a) was detached at this point. Some of the structures of Corti's organ can be recognized such as Hensen's cells (b) the base of the inner rod or pillar and the nerve fibres passing up through the basilar membrane

The nuclei of Deiter's cells are recognizable but the hair cells have apparently undergone some degree of degeneration Some distortion has probably occurred but comparison with the opposite ear indicates that the principal abnormal findings cannot be attributed to artefact

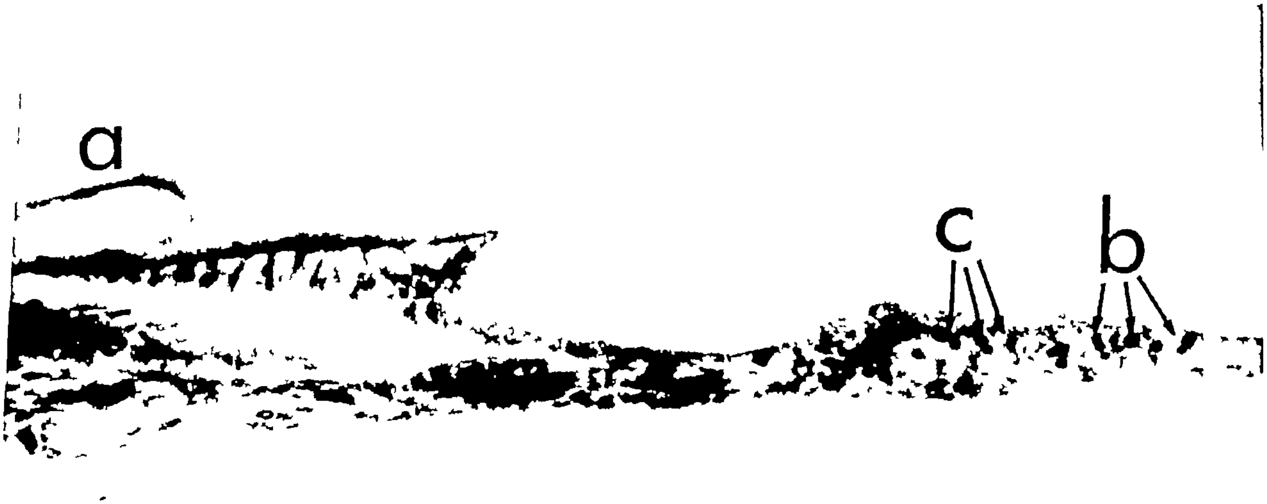


Fig 7 Right ear Displaced tectorial membrane (a) Corti s organ appears flattened out but cells of Hensen (b) and the nuclei of hair cells (c) can be distinguished under the microscope whether the displacement of the tectorial membrane was present during life cannot be stated

The endolymphatic duct and sac showed no definite abnormality The appearance of this structure on the two sides was similar The vestibular scale was almost completely occupied by the dilated cochlear duct The tympanic scale was normal except for a mound of loose fibrillar connective tissue attached to the edge of the round window membrane and medial bony margin

The cochlear duct showed no fibrosis or osteogenesis There was a small accumulation of amorphous appearing material on the spiral lamina in the middle coil The stria vascularis had undergone atrophic changes and been reduced almost to half the size of that in the opposite ear

Corti's organ and the tectorial membrane presented an unusual appearance (see Figs 5, 6, 7) In the basal coil and extending up through the first half of the middle coil, the tectorial membrane had become detached from the limbus and had apparently become attached to and incorporated into the remnants of Corti's organ

While the histologic picture is not easily interpreted, it can be observed that the hair cells and Deiter's cells in these coils were apparently absent, but that remnants of the inner and outer pillars were present The displaced tectorial membrane could be seen draped over these structures and was in turn covered by a layer of cells extending from the cells of Claudius medially almost to its inner free margin, where it could be seen projecting upwards between this covering layer of cells and the remnants of the pillars below (see Figs 5 and 6) At about the midregion of the middle coil the appearance had changed gradually (see Fig 6) The tectorial membrane had become less deeply incorporated with Corti's organ and at the upper part of the middle coil was seen to be attached to and partly overlying the limbus while still connected at its tip to the degenerated Corti's organ In the upper coil the tectorial membrane could be seen lying on the spiral lamina, at some distance from the organ of Corti The dislocation of the tectrial membrane in the upper coil as seen in the preparations was irregular and may have been due to artefact

The transition from the conditions found in the basal coil and lower half of the middle coil to that found in the upper end of the middle and in the upper coil had apparently been irregular At one point near the beginning of the upper coil the tectorial membrane lay up over the limbus and Corti's organ, although, somewhat flattened out, shows a semblance of the normal appearance (see Fig 7) The pillars were recognizable as well as Hensen's cells, and in the intervening space could be seen nuclei and somewhat distorted cells which undoubtedly were hair cells and Deiter's cells The flattening out of Corti's organ at this area and in the upper coil is so extreme as to prevent easy recognition of cell structure, but the possibility exists that this flattening out may not have been present during life

In the upper coil the tectorial membrane was not attached to the organ of Corti but was displaced to some distance In part of this coil some of the structure of the much flattened out organ of Corti could be made out The cells of Hensen were most clearly discernible, but the presence or absence of hair cells was usually in doubt The nerve fibres could be traced to the point where they passed upward through the basilar membrane in all coils

The spiral ganglion showed a diminution of cells as well as nerve fibres in the basal coil to a greater degree than was seen in the healthy ear (see Figs 3 and 4)

Summary of Histopathologic Findings The left ear showed a normal endolymphatic system, a normal cochlear duct, stria vascularis and Corti's organ. Some atrophy of nerve cells in the spiral ganglion of the basal coil was present, but not greater than is commonly found in this age period.

The right ear contained an advanced degree of hydrops of the so-called "idiopathic" type

The coagulation procedure had destroyed the ampullae and all of the proximal limbs of the horizontal and superior vertical canals and the utricle New bone and fibrous tissue replaced these structures, the latter extending down to cover all but the lower margin of the stapes footplate

The vestibular scala was obliterated by the dilated cochlear duct The stria vascularis showed moderate atrophy

Corti's organ and the tectorial membrane were fused together in the basal and most of the middle coil with an apparent obliteration of hair cells The nerves could be seen passing up through the basilar membrane into the remnants of the organ of Corti

In the upper coil the structure of the organ of Corti could be more clearly distinguished In some slides the presence of hair cells as well as their supporting cells seemed fairly definite There was a slightly greater degree of atrophy of ganglion cells and nerve fibres in the basal coil than in the opposite ear

The operative cavity in the mastoid had shown no tendency to fill in with new bone, but had become a large air cell lined by thin mucoperiosteum

COMMENT

Certain points of significance have been demonstrated by this case

The mastoid defect showed no tendency to fill in with new bone Practically no signs of osteogenesis were evident along the margins

The coagulation procedure had accomplished the objective in destroying the utricle and two semicircular canals The posterior canal and the saccule were still present, while the saccular macula appeared normal

The presence of good hearing in this ear seems difficult to understand in view of the condition of Corti's organ and the tectorial membrane in the basal and middle coils The existence of a Corti's organ which might be capable of function in at least part of the upper coil seemed fairly definite, but the histopathologic appearance of the tectorial membrane, and the component parts of Corti's organ in the basal and nearly all of the middle coils strongly suggested degenerative changes incompatible with function The conclusion seems indicated that the extent of auditory function represented in Fig 1 may have occurred without the aid of sensory cells in the basal and middle coils

---

MISSISSIPPI VALLEY MEDICAL SOCIETY
1949 ESSAY CONTEST

The Ninth Annual Essay Contest of the Mississippi Valley Medical Society will be held in 1949 The Society will offer a cash prize of $100 00, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics and education) and practical value to the general practitioner of medicine Certificates of merit may also be granted to the physicians whose essays are rated second and third best Contestants must be members of the American Medical Association who are residents and citizens of the United States The winner will be invited to present his contribution before the Fourteenth Annual Meeting of the Mississippi Valley Medical Society to be held in St Louis, Mo , Sept 28, 29, 30, 1949, the Society reserving the exclusive right to first publish the essay in its official publication — the *Mississippi Valley Medical Journal* (incorporating the *Radiologic Review*) All contributions shall be typewritten in English in manuscript form, submitted in five copies, not to exceed 5,000 words, and must be received not later than May 1, 1949 The winning essays in the 1948 contest appear in the January, 1949, issue of the *Mississippi Valley Medical Journal* (Quincy, Ill)

Further details may be secured from Dr Harold Swanberg, Secretary, Mississippi Valley Medical Society, 209-224 W. C U Building, Quincy, Ill

THE NATURE OF BELL'S PALSY *

JEROME A HILGER, M D ,
St Paul, Minn

When an apparently normal and healthy individual awakens in the morning and finds as he glances in his shaving mirror that he has lost the power of movement of one side of his face, he is said to be suffering from Bell's palsy This is not, however, the condition originally described by Charles Bell, F R S , before the Royal Society in London in 1812[1] At this time his concern was with the proper allocation of motor and sensory nerve distribution to the facial region, because of the accepted practice of dividing the peripheral trunk of the VIIth cranial nerve for the relief of tic douloureux Through various case histories and experiments he brought forth conclusive evidence that the "portio dura" of the VIIth nerve had purely motor function and had no place in the genesis of facial pain His cases included peripheral facial paralysis due to wound from a pistol ball, due to injury from the horn of an ox, and due to operation for extirpation of a tumor before the ear His careful research, thoughtful clinical observation and compelling presentation established the concept of the motor VIIth and sensory Vth which is today accepted as a matter of course In the intervening century, peripheral facial paralysis has been shown to result from a variety of causes, including trauma, infection and neoplastic compression Still, there exists a formidable number of cases not ascribable to any of these agents It is this residual group which today, for want of an etiologic description, retains the title of Bell's palsy

Many facts are known about this residual group The paralysis is rather sudden in onset — usually a matter of hours Though it has been described as painless, actually pain

---

*Read at the meeting of the Middle Section American Laryngological Rhinological and Otological Society Inc Iowa City Iowa Jan 17 1949
Editor s Note This ms received in Laryngoscope Office and accepted for publication Jan 25 1949

about the ear is a not uncommon symptom in the first 48 hours Sex has no influence The adult age group is most commonly afflicted There is a definite familial incidence Predisposition as evidenced by recurrences has some importance[2 3] There is no apparent seasonal incidence[4] Abnormal cooling of the auricular region has been cited as a cause in as high as 70 per cent of cases[5] In the absence of this physical exposure, severe emotional upset or shock has been shown to be a precipitating factor[5]

Repeated thorough general examination has failed to show common systemic organic causation There are no constant local findings in the peripheral course of the facial nerve, though it is surprising how commonly the vessels of the posterior aspect of the deep portion of the external auditory canal and of the tympanic membrane show notable injection in the first days of involvement The nerve may be involved in a segment to include the stapedial and the chorda tympani branches or involvement may be below that level Paralysis may be partial or complete, it may be permanent Faradic response may disappear in 10 days or two weeks, or recovery may occur without the loss of faradism Eighty-five per cent of cases regress spontaneously, fully or in large part There is no established prognostic sign other than the completeness of paralysis or the loss of faradism There is no unanimity as to etiology or treatment — medical or surgical

Until recent years the actual changes in the nerve trunk which destroyed its conductive function were largely a matter of conjecture Few reports of the microscopic changes in the nerve were available and few gross observations of the diseased nerve had been made Following the basic work of Ballance and Duell,[6] and encouraged by their dictum to operate and decompress the nerve once paralysis is established, many cases of Bell's palsy have come under surgical care and there has been opportunity to observe grossly the disordered trunk in various periods after the onset of paralysis[3-8] There is uniform agreement that the usual finding upon surgical exposure is edema of the nerve with the trunk most tightly constricted by the nerve sheath at its point of issuance from the stylomastoid foramen Edema is not a universal finding, however The nerve trunk may have a normal macroscopic appearance Kettel[9] has observed further that aseptic necrosis of adjoining portions of the temporal bone presumably due to ischemia is not uncommonly present This has not been confirmed by others with significant experience

Compression due to edematous swelling suggests an obvious source of paralysis Actually, failure of nerve conduction due to change in a localized segment of nerve trunk does not result from compression unless the latter is sufficiently severe to disrupt the axis cylinder This degree of compression does not occur clinically Denny-Brown and Brenner[9, 10] have shown that conduction failure is a result of ischemia as a primary cause, not compression Hence, the paralysis of the facial nerve is a result of local vascular change which by ischemia has interrupted conduction and by attendant changes in the local circulation may or may not produce edema If edema does form, the resulting compression may make the problem of relieving ischemia more difficult

In a patient in apparent good general health the question may be asked, "Why and by what mechanism is ischemia and edema produced in so localized a region?" It is apparent that it is not dependent on change in the blood elements, or in blood chemistry, or in the permeability of endothelial tissues generally To be thus localized, it must result from dynamic local vasular change The probable mechanism has been described and given experimental basis by Abell and Schenck[11] The essential features are arteriolar constriction, followed by capillary dilatation due to ischemic damage or reflux from venous tonus, a widening of space between endothelial cells,[12] and resultant transudation To fully understand this sequence the basic work of Krogh[13] on capillaries, and Hudack and McMasters[14, 15] on lymph capillaries must be appreciated The pressure of fluid transudate is rapidly transmitted to the walls of the lymph capillaries and they may be closed by compression Additional fluid then accumulates and compression of capillaries and venules creates further zonal ischemia and a blanched wheal results This dynamic mechanism of ischemia and edema formation has been shown to result from the precipitant influence of physical exposure or emotional stimuli in certain individuals who have an inherent tendency for this eccentric behavior in their arterioles[16]. The impetus to arteriolar constriction in such instance is derived from autonomic nervous impulsion to the involved vessel. It is probable that the tendency is actually inherited through the inheritance of one's autonomic system and its potential imbalances. These imbalances in the head segments are expressed in large part through vagaries in the function of the carotid arterial tree. A high percentage of patients with Bell's palsy give history of other manifestation of carotid vasomotor disturbance: chronic vasomotor rhinitis, vasodilating pain, cervical myalgia, or vasomotor labyrinthitis.

The vessels of most vital physiologic import in any arterial trunk system are the arterioles. Because of the anatomy of their autonomic innervation in the peripheral vascular areas, arterioles tend to behave in segmental arterial branch fashion rather than in diffuse, haphazard manner. When the arterioles of a small segmental branch of the carotid tree constrict simultaneously the resultant ischemia produces interesting clinical conditions in the tissues supplied by that branch. The conditions may vary widely according to the cranial tissue involved. In the case of end-arteries without collaterals, a peripheral cataclysm may occur as, for example, in the inner ear[17]. In a confined anatomic situation where associated edema is able by compression to prevent collateral arterial supply, an analagous condition is created. Edema within the firm fibrous sheath of the facial nerve in the region of the stylomastoid foramen is an example.

There is a collateral arterial supply which can modify the ischemia of the facial nerve produced by widespread arteriolar constriction of the stylomastoid arterial bed. There are two principal anastomoses. The first is that of the terminal branch of the stylomastoid artery with the superior petrosal branch of the middle meningeal through the hiatus for the great superficial petrosal nerve. The second is that of the posterior tympanic branch of the stylomastoid artery which leaves the facial canal with the chorda tympani and in the posterior aspect of the tympanum and tympanic membrane anastomoses with other branch arteries to the tympanum from the internal maxillary, the ascending pharyngeal, the middle meningeal and the carotid arteries

Hyperacusis resulting from stapedial nerve paralysis and the loss of taste sensation due to chorda tympani involvement are common in the early period of Bell's palsy Restoration of the normal function of these two branches commonly occurs in spite of continued facial paralysis It probably results from early relief of ischemia at the knee of the facial nerve due to these two anastomoses There is little or no collateral supply to relieve the ischemia below this level

Spasm in arteriolar terminals can produce dilatation in their arterial trunk This dilatation in the fine arterial segments of the posterior tympanic branch of the stylomastoid artery accounts for the injection in the region of the posterior annulus frequently seen in the first days of ischemia and palsy Segmental peripheral spasm may be sufficiently widespread to cause retrograde arterial dilatation in larger branches and in the stylomastoid artery itself The vasodilating pain produced is that not uncommonly seen with the onset of Bell's palsy It usually denotes ultimate severe ischemic involvement

Since this paralysis is an ischemic neuritis, its relief may be expected to hinge upon the restoration of circulation in the involved stylomastoid arterial segments Immediate nonsurgical measures must be directed toward relief of arteriolar spasm These may embrace vasodilating drugs with peripheral effect such as nicotinic acid, intravenous histamine or papaverine, or with sympathetic paralyzing effect as ergotamine tartrate or tetraethylammonium chloride, or cervical sympathetic block The ischemia of the vertical segment of the nerve trunk must be countered through the constricted arteriolar bed, since collateral supply is not present The secondary factor of compression by edema may be eased by surgical exposure of the involved trunk, however, 85 per cent of cases get eventual satisfactory return of function without this major surgical procedure There is no clear-cut early method of determining which individual cases will constitute the unhappy 15 per cent with residual paralysis An immediate major surgical procedure on all cases to salvage this 15 per cent may not receive wide acceptance

Motor conduction through the ischemic nerve trunk is interrupted when ischemia results in destruction of myelin sheath.[9 10] This appears first at the nodes of Ranvier The reaction of degeneration, on the other hand, will not be present until ischemic necrosis of the axon occurs This clinically occurs most frequently after 10 to 14 days By this time the most advanced degree of ischemic functional damage is present and a prolonged course is assured Recovery from this phase commonly results in associated facial movements because it is possible for regenerating axons to cross the necrotic area and progress into wrong myelin tubules This will be true whether the nerve is now surgically decompressed or not A significant number of patients with this advanced degree of ischemic damage still make satisfactory spontaneous recoveries The percentage of such patients has not been accurately determined, but it is high enough to discourage a dictum of universal nerve decompression at the first appearance of the reaction of degeneration, since necrosis is already an established fact

As long as the opportunity for spontaneous recovery is not being jeopardized by waiting, surgery seems contraindicated Waiting until fibrosis in the nerve trunk replaces necrosis is certainly unwise[5 18 19] The time of this transition has not been determined and must depend on variable factors of circulation in the impaired area It seems probable certainly that this period may be much longer than is commonly accepted, as long as facial musculature is maintained in a receptive state through electric stimulation, support and massage This view is supported by the infrequent occurrence of fibrosis in surgically exposed nerve with paresis of fewer than six months' duration

What, then, can surgical decompression offer? First, in the very nature of surgical trauma to the local area of arteriolar constriction, dilatation may be reflexly stimulated Second, release of the constricting sheath relaxes pressure on lymph and blood capillaries and arterioles and venules, and mechanically facilitates subsequent vasodilating therapy Third, circulation to the nerve through normal or collateral channels may be supported eventually by revascularization from adjoining soft tissues

The principal error in therapy today would appear to be a do-nothing attitude toward nonsurgical measures It has been encouraged over the years by an absence of conviction regarding the pathogenesis of the palsy The natural tendency toward the restoration of normal vascular tonus results in spontaneous recovery in 85 per cent of cases It can be facilitated by therapeutic measures directed to the relief of vaso spasm These are just as important postoperatively, and may enhance the surgical result in cases of long duration which eventually come to surgical decompression, as well as in cases subjected to decompression immediately after the onset of paralysis

SUMMARY

Bell's palsy is an ischemic neuritis

It results from segmental arteriolar spasm

The latter may also produce edema as a secondary phenomenon

Therapy should be directed toward the relief of vasospasm

In some cases it may be necessary to facilitate vasodilating therapy by surgical decompression of the edematous nerve trunk

BIBLIOGRAPHY

1 Bell, Charles On the Neres of the Face *Phil Trans Roy Soc of London*, 1829

2 Wilson, S A K, and Bruce, A Ninian Neurology Baltimore Williams and Wilkins, 1940, p 394

3 Kettel, Karsten Bell's Palsy Pathology and Surgery *Arch Otolaryngol* 46 427-472 Oct 1947

4 Winternitz, P Question of the Existence of Rheumatic Paralysis *Monatsschr f Psych u Neurol* 113 17 39 1947

5 Hirschmann Oppenheim Williams (quoted in S A K. Wilson and A. Ninian Bruce Neurology Baltimore Williams and Wilkins 1940 p 394)

6 Ballance, C and Duel, A. B The Operative Treatment of Facial Palsy *Arch Otolaryngol.*, 15 1 Jan 1932

7 Tickle, J G The Surgical Treatment of Facial Paralysis Loose Leaf Surgery of the Ear New York Nelson 1938

8 Cawthorne, T Peripheral Facial Paralysis Some Aspects of Its Pathology The Laryngoscope, 56 653 1946

9 Denny-Brown D and Brenner, C Paralysis of Nerve Induced by Direct Pressure and by Tourniquet. *Arch Neurol and Psych* 51 1 27, 1944

10 Denny Brown D and Brenner, C Lesion in Peripheral Nerve Resulting from Compression by Spring Clip 52 1 20 1944

11. Abell, R G and Schenck, H P *Jour Immunol* 34 185-213 Mar 1938

12 Landis E M. The Passage of Fliud Through the Capillary Wall Harvey Lecture Nov 19 1936

13 Krogh August The Anatomy and Physiology of Capillaries Yale University Press 1930

14. Hudack S., and McMaster, P D *Jour Exper Med* 56 223 238 Aug 1932

15 Hudack, S and McMaster, P D *Jour Exper Med* 57 751-774 May 1933

16 Muller, Otfried Ueber den Saftestrom in Blut Gewebsspalten und Lymphbahnen. *Schweiz Med Wchnschr* 70 365-369 Apr 27 617 621 June 29 778-782 Aug 17 901-906 Sept 21 1940

17 Hilger, J A. Autonomic Dysfunction in the Inner Ear In press

18 Duell, A. B., and Tickle, T G The Surgical Repair of Facial Nerve Paralysis *Ann Otol., Rhinol and Laryngol* 45 3 1936

19 Morris William Surgical Treatment of Bell's Palsy *Lancet*, 1 429 1938 2 558 1939 2 1172 1936

444 Lowry Medical Arts Building

AMERICAN BOARD OF OTOLARYNGOLOGY

The American Board of Otolaryngology will conduct the following examinations in 1949

May 11 to 14 in New York, N Y , at the Biltmore Hotel

Oct. 4 to 7 in Chicago, Ill , at the Palmer House.

COMPARISONS OF THRESHOLDS FOR SPEECH WORD AND SENTENCE TESTS, RECEIVER vs FIELD, AND MONAURAL vs BINAURAL LISTENING*

M R BREAKEY, M S,† and H DAVIS, M D,
St Louis, Mo

In a previous paper[1] one of us has pointed out the theoretical and practical usefulness of knowing the relative difficulty of various tests of the threshold for speech and also the absolute values of these thresholds for normal ears, furthermore, it is useful to know the articulation score, as measured by the "PB" (phonetically balanced) word lists,[2] that a listener would be expected to make at his threshold for speech measured by, let us say, Test No 9[3] We may also wish to know the differences between monaural and binaural listening and between listening in a free field and listening to the same material under a receiver

Some of these comparisons have been made before, notably those between monaural and binaural listening and between "free-field" and receiver listening Our present findings will serve in part to confirm previous results and in part to extend them to hard-of-hearing listeners Also they represent an experimental calibration of the particular recordings of the tests and the particular sound systems employed at Central Institute for the Deaf Let us emphasize again that *the particular numerical values for thresholds for speech and for corresponding articulation scores are valid only for these particular recordings* and then only when they are reproduced over a high-fidelity system The differences between the

---

*From the Research Laboratory of the Central Institute for the Deaf This work was conducted under Contract N6onr-272 between the Office of Naval Research and Central Institute for the Deaf The experimental material formed part of the basis of a thesis submitted by one of the authors (MRB) in partial fulfillment of the requirements for the degree of Master of Science in Education Washington University

†Now at Day School for the Deaf Burlingame Calif

Editor s Note This ms received in Laryngoscope Office and accepted for publication Dec 24 1948

thresholds under different conditions of listening are probably valid for other versions and even for other tests, but they are still restricted to sound systems and room acoustics such as we use for our so-called "field tests"

This report compares the results of a series of hearing tests made on two relatively small groups of listeners One group had "normal" hearing, the members of the other group were hard of hearing to various degrees The same individuals participated in all of the tests, and many valid intercomparisons are possible Some of the results have already been incorporated in a previous paper,[1] but the details of method and many additional data are presented below

TEST ROOM AND APPARATUS

The test room and electro-acoustic apparatus used in giving the articulation tests have already been fully described[6] Briefly, they consist of

1 A test room with an ambient noise level of 38 db measured with a Western Electric RA 330 sound level meter weighting network set at flat.'* With the weighting network set at '40 db' the noise level is not over 33 db The room is not a true free-field room however it is lined with three inches of rock wool which provides considerable sound absorption. Tests made with the loudspeaker in this room will therefore be referred to as field tests rather than free field tests

2 A high fidelity electro acoustic system capable of delivering speech without overload-distortion at sound pressure levels up to 142 db (through a pair of calibrated PDR 10 receivers) and to 100 db in the field (through a Western Electric 753 B loudspeaker) A suitable dividing network was inserted to deliver the test signal through two attenuators to the two receivers Each attenuator was capable of introducing up to 110 db of attenuation to eliminate one ear for monaural measurements and to equate the ears for binaural measurements

3 Additional attenuators and a vu meter for measuring and regulating the sound level in steps of 2 db with an accuracy of ± 1 db

4 Electrical transcription reproducer for playing the test records

5 Operator's microphone and a talk back system for communication between the test room and the control room

---

*American Standards Association Specification Z24-3 1944

CALIBRATION

Room

A 1000 cycle tone was introduced through the Western Electric 753 B loudspeaker in the sound treated room A sound level microphone was hung at the position of the subject's ears two meters in front of the loud speaker The sound level meter indicated a sound pressure level of 90 db above 0 0002 dyne/cm^2 when the vu meter read 24 vu The vu meter was bridged across the primary of the speaker transformer (600 ohms)

Receivers

A calibrating voltage of 0 1 v r m s at 1000 cycles was measured across the terminals of the PDR 10 receivers Measurements were made with a Ballantine vacuum tube voltmeter This voltage produces 111 db sound pressure level (re 0 0002 dyne/cm^2) in a 6 cc coupler according to calibration by the Electro Acoustic Laboratory Harvard University The two receivers used were expressly chosen for their practically identical frequency response characteristics

DESCRIPTION OF SPEECH TESTS

1 The Threshold for Speech Psycho Acoustic Laboratory Test No 9

This test consists of 84 spondaic words (two syllables with equal stress such as cowboy' and 'baseball") Each list of 42 words is a different scrambling Lists are recorded in groups of six at levels progressively lower by 4 db steps The 'No 9 threshold is the level, calculated by the tabular method described by Hudgins, *et al*,[3] at which the listener can repeat correctly 50 per cent of the words Correction was made for the slight differences in difficulty among the recordings employed[3]

2 The Threshold for Speech Psycho Acoustic Laboratory Test No 12

This test consists of simple sentences recorded in groups of four at levels progressively lower by 4 db steps[3] The No 12 Threshold" is the sound level calculated by the tabular method at which the listener can repeat correctly 50 per cent of the sentences Correction was made for the slight differences in difficulty among the recordings employed[3]

3 The Threshold for Speech Psycho Acoustic Laboratory 'PB' Word Lists

Recordings of eight of the 50 word phonetically balanced lists of monosyllables developed at Psycho Acoustic Laboratory[2] were used in this study The lists are proportionately representative of the phonetic elements of normal spoken English The lists were recorded in the Technisonic Laboratory at Central Institute for the Deaf with a trained radio announcer as the talker The lists are recorded at a constant level and are scored as percentage of total items correctly repeated

DESCRIPTION OF SUBJECTS

Group I was made up of ten "normal" listeners All twenty ears were found to be normal by an examining otologist and by audiometric examination An audiogram was considered normal if it showed no hearing loss of more than 10 db at any of the octave frequencies from 256 to 4096 cps inclusive The ages of the group ranged from 19 to 24 years All but one of these subjects were completely untrained listeners

Group II consisted of ten hard-of-hearing subjects, four were cases of predominantly conductive deafness, two of mixed deafness, and four had serious nerve involvement Division into types was determined from the audiograms and the otological findings Their ages ranged from 26 to 53 years Table 1 shows the audiometric data for Group II

Tests were given through the receivers to Group I in the following order

1 Test No 9, right ear
2 Test No 12, right ear
3 Test No 12, left ear
4 Test No 9, left ear
5 Test No 9, binaurally
6 Test No 12, binaurally

Different forms of both the No 9 and No 12 lists were used for each test Since the two ears of the normal subjects were very nearly equal in acuity for pure tones they were not further equated Each ear received the stimulus at the same intensity

The same order was used in the presentation of the tests in the field Then two PB lists were given at a level of 10 db above the subject's No 9 binaural field threshold For all monaural tests in the field the subject blocked out the ear not being tested by inserting a finger in the external canal to give as complete a seal as possible This method provided sufficient attentuation as the starting levels were never over 50 db (re 0 0002 dyne/cm^2) To insure that the subject kept his head in the same position relative to the loudspeaker, an adjustable head-rest was used and the subject was asked to keep his head in the head-rest during the test

Frequent rest periods were given between tests to insure against fatigue

The procedure for Group II differed from that for Group I

TABLE 1

AUDIOMETRIC DATA FOR HARD OF HEARING LISTENERS

		Hearing Loss in Decibels									
Frequency		128	256	512	1024	2048	2896	4096	5792	8192	No 9
Subject	Ear										
R E	R	60	60	65	60	65	85	80	65	70	62
	L	40	45	55	60	60	70	75	65	70	59
M S	R	65	55	65	65	55	45	50	35	50	61
	L	65	60	65	60	55	45	45	35	50	60
C B	R	60	70	75	70	75	75	100	NT	75	72
	L	55	65	70	70	70	80	90	NT	80	71
A C	R	45	50	55	55	55	65	90	x	x	57
	L	40	45	55	45	40	55	55	60	75	51
W T	R	20	30	40	65	65	70	65	70	70	50
	L	5	10	35	55	65	60	60	55	60	49
M W	R	65	55	60	60	55	50	55	60	60	61
	L	65	65	70	90	85	75	85	80	x	88
R H	R	35	45	50	50	50	55	60	75	65	51
	L	40	40	55	55	60	50	85	65	65	58
I C	R	55	60	65	70	60	50	55	45	60	69
	L	35	45	55	60	55	60	45	55	60	60
M C	R	60	60	70	75	75	75	75	75	x	77
	L	65	65	75	80	95	80	85	75	80	79
F D*	R	5	0	10	15	15	15	20	15	30	18
	L	50	55	55	65	75	75	80	75	80	67

No 9 = Loss for speech as determined by Test No 9
x = Indicates that the tone was not heard at the limit of the audiometer
NT = No test made * = Test made with opposite ear masked.

in that more articulation tests were administered, but Group II did no listening "in the field" In general the same sequence of tests was followed For binaural listening, however, the ears were equated by attenuating the starting level in the better ear by the difference in decibels between the right and left monaural thresholds The two ears were then functionally equal

RESULTS AND INTERCOMPARISONS

1 *Receiver Listening vs Field Listening, Normal Hearing, Monaural and Binaural*

The mean thresholds for Group I, Tests No 9 and No 12, under four conditions of listening are given in Table 2 It is evident that the thresholds are systematically lower for field listening (in our room) than for receiver listening The differences are slightly greater for Test No 12 than for Test No 9 and for monaural than for binaural listening, but these differences are of questionable significance The difference of about 3 db (average of all tests) between field and receiver listening is real, although not so large as would be expected from the classical data[3] on minimum audible pressure and minimum audible field thresholds for pure tones The smaller difference in the present series may be due in part to the fact that our field is not a "free" field It is also due in part to the unusually low average threshold found for Test No 9 by receiver listening

2 *Test No 9 vs Test No 12*

The mean thresholds for these two tests, determined under the various conditions of listening, are given in Table 3 All of the differences are statistically significant at the one-per-cent level as determined by the "t" test for small samples[4] The average difference, for field listening, is 4 27 db This agrees well with the experience of the Psycho-Acoustic Laboratory and the previous experience at Central Institute for the Deaf as to the relative thresholds of the two tests For receiver listening the difference is greater, namely, 6 64 db The greater difference appears consistently for right ear, for

TABLE 2

COMPARISONS OF RECEIVER AND FIELD LISTENING FOR LISTENERS WITH NORMAL HEARING

Thresholds in Decibels Above 0 0002 dyne/cm^2

			RECEIVERS		FIELD			
Test	Ear	N	Mean Thresh-old	SD	Mean Thresh-old	SD	Diff	SE
No 9	R E	10	19 40	2 80	17 40	2 98	2 00	0 82
	L E	10	19 70	3 23	17 60	2 91	2 10	1 31
	Mon	20	19 55	2 72	17 50	2 59	2 05	0 75
	Bi	10	17 70	2 19	16 70	3 13	1 10	0 91
	All tests	30	18 93	2 91	17 23	3 03	1 70	0 58
No 12	R E	10	27 10	3 91	21 40	2 11	5 70	0 96
	L E	10	26 20	4 47	22 40	2 33	3 80	1 33
	Mon	20	26 65	3 89	21 90	1 93	4 75	0 83
	Bi	10	23 40	3 53	20 70	2 24	2 70	1 18
	All tests	30	25 57	4 29	21 50	2 33	4 07	0 69
No 9 and No 12	R E	20	23 25	2 57	19 40	2 19	3 85	0 74
	L E	20	22 95	3 53	20 00	2 12	2 95	0 93
	Mon	40	23 10	2 96	19 70	2 16	3 40	0 59
	Bi	20	20 55	2 60	18 70	2 30	1 85	0 75
	All tests	60	22 25	2 84	19 37	2 27	2 88	0 47

Mon = Monaural all ears.
Bi = Binaural.
SD = Standard Deviation
SE = Standard Error of the Mean of the Differences.

TABLE 3

COMPARISONS BETWEEN TEST No 9 AND TEST No 12 FOR LISTENERS WITH NORMAL HEARING

			Thresholds in Decibels Above 0 0002 dyne/cm²				Difference	
			No 9		No 12			
	Ear	N	Mean Threshold	SD	Mean Threshold	SD	Db	SD
Receivers	R E	10	19 40	2 80	27 10	3 91	7 70	1 18
	L E	10	19 70	3 23	26 20	1 17	6 50	1 39
	Av Mon	20	19 55	2 72	26 65	3 89	7 10	1 00
	Bl	10	17 70	2 19	23 40	3 53	5 70	0 92
	All tests	30	18 93	2 91	25 57	1 29	6 64	0 73
Field	R E	10	17 40	2 98	21 40	2 11	4 00	0 91
	L E	10	17 60	2 91	22 40	2 33	4 80	1 01
	Av Mon	20	17 50	2 59	21 90	1 93	4 40	0 70
	Bl	10	16 70	3 13	20 70	2 21	4 00	0 97
	All tests	30	17 23	3 03	21 50	2 33	4 27	0 55
Receivers and Field	R E	20	18 40	3 06	24 25	1 21	5 85	0 95
	L E	20	18 65	3 25	24 30	1 01	5 65	0 87
	Av Mon	40	18 53	3 15	24 28	1 13	5 75	0 63
	Bl	20	17 20	2 75	22 05	1 25	4 85	0 68
	All tests	60	18 08	3 09	23 53	1 00	5 45	0 16

Av Mon = Average Monaural or average of right and left ears
Bl = Binaural
SD = Standard Deviation
SE = Standard Error of the Mean of the Differences

left ear, and for binaural listening It is important to notice, however, that the absolute value of the normal monaural threshold (receiver) for Test No 12 is 26 65 ± 3 89 db and for Test No 9 it is 19 55 ± 2 72 db The value for No 12 agrees with the norm of 26 db previously accepted at Central Institute for the Deaf for this test The value for No 9 is 2 91 db below our previously accepted normal of 22 5 db Here again, as in the difference between field listening and receiver listening, the difference that involves the threshold of No 9 for Group I gives results that agree less well with other comparable data than do our other findings We are inclined to attribute the aberrant low threshold of No 9 in this series to the vagaries of small samples We now accept 22 0 db as norm for Test No 9[1]

The differences between the thresholds of Test No 9 and of Test No 12 for Group II (hard of hearing) are given in Table 4 These differences are all statistically significant according to the "t" test, and the over-all average difference of 5 31 db is in fair agreement with the 4 db that we expect according to our current standards Obviously there are no absolute norms with which to compare our values The difference between No 9 and No 12 is the same for our hard-of-hearing subjects who are classified as having "predominantly conductive" hearing loss as for those whose loss is "predominantly nerve"

TABLE 4
MEAN DIFFERENCES BETWEEN THRESHOLDS FOR TEST No 9 AND TEST No 12

HARD-OF-HEARING LISTENERS USING RECEIVERS

	N	Mean Difference	SE
R E	10	5 95 db	1 11
L E	10	5 20 db	0 67
Average Monaural	20	5 58 db	0 63
Binaural	10	4 77 db	0 65
All Tests	30	5 31 db	0 46

3 *Monaural vs Binaural Listening*

The comparisons of the mean binaural thresholds with the average of the monaural thresholds for Group I under the two listening conditions, receiver and field, are shown in Table 5

In every case the mean binaural threshold is lower than the average monaural, but not all the differences are significant statistically The series of field tests show smaller differences which are not significant individually, however, if all field and receiver tests are taken together, the difference of 1 78 db in favor of binaural listening should be found by chance alone less than once in 100 times

The differences between the binaural threshold and the threshold for the *better* ear are very small and are not significant until combined as a group Then the binaural threshold for receiver listening averages 1 4 db lower, and the difference is significant at the 2 per cent level For field listening, however, there is no significant advantage for binaural listening over listening with the better ear *

The results of our comparisons made with receiver listening are comparable with several other studies, although the others have usually employed pure tones or white noise as the stimu-

TABLE 5

COMPARISONS OF BINAURAL AND AVERAGE MONAURAL THRESHOLDS OF LISTENERS WITH NORMAL HEARING

	Thresholds in Decibels Above 0 0002 dyne/cm^2					
	Mean Av Mon. Threshold	Mean Binaural Threshold	Difference	SE	t	P
No 9 Receiver	19 55	17 70	1 85	60	3 08	02
No 12 Receiver	26 65	23 40	3.25	77	4 25	01
All Receiver Tests	23 10	20 55	2 55	50	5 10	01
No 9 Field	17 50	16 70	0 80	72	1.12	40
No 12 Field	21 90	20 70	1 20	56	2 15	05
All Field Tests	19 70	18 70	1 00	45	2.22	05
All tests Receiver and Field	21 40	19 62	1 78	35	5 09	01

t = Critical ratio

P = Level of confidence For example the figure 02 indicates that there are two chances in one hundred that this is not a true difference

For other abbreviations see Table 2

---

*These data are not tabulated in this paper but may be found in the thesis mentioned in the first footnote.

lus or have relied merely on the threshold of detectability (not intelligibility) of speech.

Shaw, Newman and Hirsh,[5] in their review of past experiments using pure tones, reported that the differences found between binaural and average monaural thresholds vary from 1 to 3 db. In one experiment with speech conducted by these authors using Test No. 9 a difference of 3.9 db appeared. This compares with the difference of 2.55 db in our experiments using Tests No. 9 and No. 12 (see Table 5). They also report that the binaural thresholds were from 1 to 2 db lower than the best monaural threshold. The present study shows a difference of 1.4 db.

Keys used sentences as the stimulus in his study of monaural versus binaural hearing and found binaural thresholds approximately 3.5 db lower than mean monaural thresholds and 2.4 db lower than better ear thresholds when the ears were not equated in sensitivity. The No. 12 sentence test used in the present study would be comparable to the material used in his experiment and our results from its administration show a mean binaural threshold 3.25 db lower than the mean monaural and 2.0 db lower than the better ear threshold.

Evidently the binaural threshold for speech intelligibility behaves very similarly to the binaural threshold for pure tones and the binaural advantage is approximately 3 db.

Several investigators have tried equating the two ears, that is, making them equal in sensitivity, and then measuring the binaural threshold. In the present study this procedure was followed with Group II, the hard of hearing. The difference between the two ears as measured by the respective thresholds on Test No. 9 varied considerably, as might be expected with subjects whose hearing is defective. One case, F. D., was not used in these comparisons as the difference between her ears was so great that it would have been impossible to get a true binaural reading. With the other nine subjects the stimulus to the better ear was attenuated by the difference in decibels between the No. 9 thresholds of the two ears. The two ears were thus made functionally equal.

Table 6 presents the monaural-binaural data obtained for Test No 9 The differences shown are those by which the binaural thresholds are lower than the monaural

The mean advantage of 2 83 db for binaural listening on Test No 9 has a critical ratio of 5 78 and the chances that this is a real difference are much greater than 1 in 100

The differences between binaural and monaural thresholds on Test No 12 are not so easily expressed, as the ears were equated according to the results that appeared between the thresholds of the two ears on Test No 9 The actual differences in thresholds on No 12 were not always quite the same as those on No 9 The differences between the reference monaural scores were, therefore, not exactly the same as those used in equating the two ears, and the binaural score had to be compared not only to the more sensitive but also to the less sensitive ear As the difference between the two ways of computing the score was only about half a decibel it was decided arbitrarily to use the comparison with the better ear Table 7 shows the advantage for binaural listening on Test No 12

TABLE 6

BINAURAL ADVANTAGE FOR HARD-OF HEARING LISTENERS

TEST No 9

RECEIVER LISTENING	EARS EQUATED
Subject	Binaural Advantage
R. E	4 0 db
M S	2 0
C S	1 0
A. C	2 0
W T	1 0
M S	4 5
R H.	2 5
I C	5 0
M C	3 5
Mean Binaural Advantage	2 83 db
Standard Error of the Mean of the Differences	0 49 db

It is interesting that all but one of the hard-of-hearing subjects stated that it was "easier to listen binaurally than

TABLE 7
BINAURAL ADVANTAGE FOR HARD OF HEARING LISTENERS
TEST No 12

RECEIVER LISTENING EARS EQUATED FOR TEST No 9	
Subject	Binaural Advantage
R E	5 5 db
M S	3 0
C B	2 5
A C	3 0
W T	4 0
M W	6 0
R H	3 0
I C	5 0
M C	1 0
Mean Binaural Advantage	3 67 db
Standard Error of the Mean of the Differences	0 53 db

The binaural advantage is reckoned from the best monaural threshold for Test No 12 (further explanation in text)

TABLE 8
MEAN BINAURAL ADVANTAGE FOR HARD OF HEARING LISTENERS ALL TESTS

Test	Mean Binaural Advantage	SE	t	P
No 9	2 83 db	49	5 78	01
No 12	3 67 db	53	6 92	01
All tests	3 25 db	37	8 78	01

SE = Standard Error of the Mean of the Differences
t = Critical ratio
P = Level of confidence

with one ear alone" The basis for this psychological impression is not easy to identify

Table 8 shows the mean binaural advantage for each test and for the two combined All differences are significant and could have happened by chance alone less than once in a hundred times

The mean binaural advantage of 3 25 db for both speech tests compares almost exactly with the gain of 3 2 db on Test No 9 found by Shaw, Newman and Hirsh[5] in a series of similar experiments on normal listeners It is also of the same order of magnitude as the 4 14 db binaural advantage for speech found by Keys when he equated the ears of his hard-of-hearing subjects

4 *Relation of "PB Threshold" to Test No 9*

Earlier results from 152 tests on hard-of-hearing patients[5] showed that the PB threshold is 11 25 db above the threshold for Test No 9 In order to determine experimentally whether this relationship is the same for normal ears, each of the normal listeners in Group I was given two PB lists in the field at a level 10 db above his previously determined No 9 binaural field threshold The intensity of the speech was then sufficient for him to make a score of almost 50 per cent The mean "PB score" for our normal listeners at a level 10 db above their No 9 thresholds was actually 46 7 per cent with a standard deviation of 6 6 per cent

The normal articulation curve for the PB word lists rises at the rate of 3 85 per cent per decibel increase in intensity[1] It is, therefore, easy to calculate the level of the PB threshold and the probable PB articulation score at the No 9 threshold A score of 50 per cent would be expected at a level 0 9 db higher than the 46 7-per-cent-correct level, *i e* 10 9 db above the No 9 threshold Also at their No 9 thresholds our subjects would probably understand 46 7 – 38 5 or 8 2 per cent of the PB words This figure is practically identical with Thurlow, *et al's*[5] calculated value of 8 per cent for normal listeners We conclude that for normal listeners as well as for hard-of-hearing listeners the PB threshold is about 11 db above the threshold for Test No 9

SUMMARY

Auditory Tests No 9 (spondee words) and No 12 (sentences) of the Psycho-Acoustic Laboratory were administered to ten subjects with normal hearing and to ten who were hard-of-hearing They were given monaurally and binaurally through headphones and, for the "normals," binaurally from a loudspeaker

Field listening showed a mean threshold for the two tests lower by 2 88 ± 0 47 db than receiver listening

CHART 1 THE COAGULATION (CLOTTING) OF BLOOD

The Essential Agents

1. Prothrombin (a globin)
2. Thromboplastin (lipoids—phosphatides?
3. Calcium
4. Fibrinogen (a globin)

Reacts to form thrombin

1, 2 and 3 interact to form an active enzyme (thrombin) which reacts with fibrinogen, changing it to an insoluble gel (fibrin) which constitutes the clot

1. Prothrombin plus thromboplastin plus calcium equals thrombin
2. Thrombin plus fibrinogen equals fibrin* (the clot)

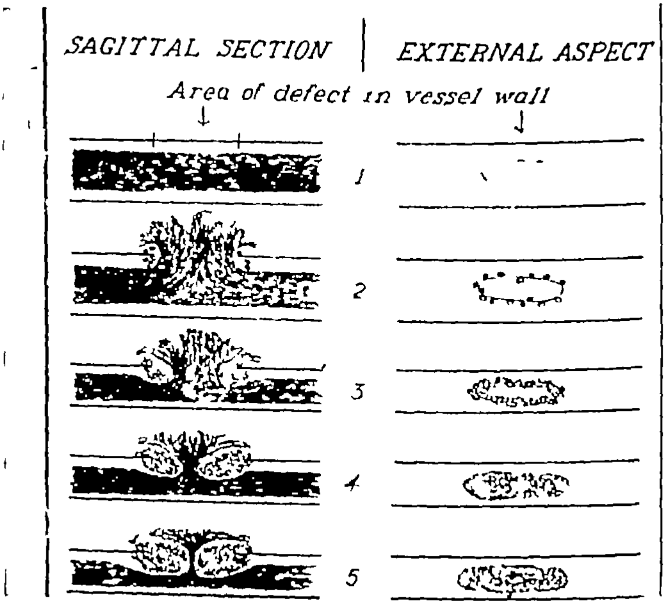


Diagram 2 (1) Intact vessel full of blood (2) Break in wall of vessel with outflow of blood — leucocytes rush to injured margins (3) Lumen of vessel constricted by fibrin and leucocyte mass Flow of blood slowed (4 and 5) Lumen further diminished by increasing hemostatic plug until vessel wound closed off and blood loss controlled

Dynamics of Hemostasis Tocantins[2] has graphically shown that immediately after a vessel is severed and blood begins to escape, pressure within it begins to fall and its lumen tends to become smaller If blood extravasates into the sur-

---

*Insoluble protein not found in normal blood
Howell W H Physiology 1935
Quick A J Jour A M A 110 1658 1948

rounding tissues, the pressure about the vessel builds up and causes the mass of blood to flow through adjacent vessels The blood flow through the injured vessel is reduced, and the blood is permitted to come into contact with the tissue fluids and platelets to mass at the site of the injury This may be all that is necessary to control the bleeding from a small vessel by plugging it with a clot

It is evident, then, that the structure of the vessel wall and the pressure of the blood within largely determine the efficiency of each hemostatic factor In arteries, when the blood pressure is 100 to 120 mm of hemoglobin, and in arterioles where it is 60 to 70 mm, massing of platelets and plugging by clot is less efficient than in capillaries and venules where the pressure is 30 to 40 mm and 10 to 20 mm, respectively

From this brief survey, it follows that all efforts at hemostasis after tonsillectomy, by means of packs, sponges, contraction, and retraction of the vessel walls by ligatures, clamps, astringents, etc, and the forming of hemostatic fibrin plugs by supplying or aiding the body to produce the substances necessary to blood coagulation, are attempts to aid these processes of the natural mechanism of hemostasis

Etiology of postoperative Tonsil Hemorrhages There are many and varied causes of post-tonsillectomy bleeding Some of these will be dealt with in detail, while others will be mentioned only in passing

Blood dyscrasias such as hemophilia, leucemia, the purpuras and hepatic diseases interfere with the constituents of clot formation and promote hemorrhage

In cases of hypertension and sclerosis of the vessel walls, a firmer plug and more extravascular pressure is needed to control bleeding

Recent acute infections of the tonsils result in engorgement of and increased blood flow in the vessels in and about the tonsils The presence of chronic infections, including Vincent's and syphilis, interfere with clot formation and may dissolve the clot or even erode a vessel wall Most of us have seen these cases associated with delayed hemorrhages, following sudden increase in pain and rise in temperature Infection is probably a very frequent cause of delayed bleeding, and McGovern[3] reports a decrease in his hemorrhages by the use of sulfathiazole chewing gum He reported 150 cases of tonsillectomy with only two hemorrhages (1 3 per cent), a series too small to be conclusive

In 1944, Neivert and his co-workers[4] corroborated previous studies showing that salicylates might cause hypoprothrombinemia He concluded that aspirin was a major cause of post-tonsillectomy hemorrhages

TABLE 3

INCIDENCE OF DELAYED HEMORRHAGES ENCOUNTERED AFTER TONSILLAR OPERATIONS IN THE YEARS 1939 1947

Without Synkavite medication			With Synkavite Medication		
Year	No of T & A	No of Late Hemorrhages	Year	No of T & A	No of Late Hemorrhages
1939	284	13	1944	385	8
			(no change of technique to this point)		
1940	256	11	1945	483	19
1941	226	16	1946	518	6
1942	303	19	1947	451	3
1943	354	16			
Total	1,423	75	Total	1 837	36
Incidence of delayed hemorrhage 5 2%			Incidence of delayed hemorrhage 1 95%		

In 1945, the author[6] presented a study of 1,808 cases of tonsillectomy performed during the period from 1939 to 1944, inclusive Twenty-five immediate and 83 delayed hemorrhages were reported in this series An average yearly incidence of 5 3 per cent delayed hemorrhages was reduced to 2 08 per cent when vitamin K (synkavite — Hoffmann-LaRoche) was given for 10 days postoperatively Since that time, 1,452 cases have been studied, with 28 delayed hemorrhages This reduces the percentage of bleeding from 5 27 per cent before the use of vitamin K to 1 95 per cent when vitamin K was used postoperatively

In this work, an attempt was also made to correlate the hemorrhages with the time of year when infections are most prevalent The difference in the percentage of bleeding cases in winter months was only 1 per cent greater than those occuring during the summer months This would tend to minimize the importance of infection on tonsillar hemorrhage

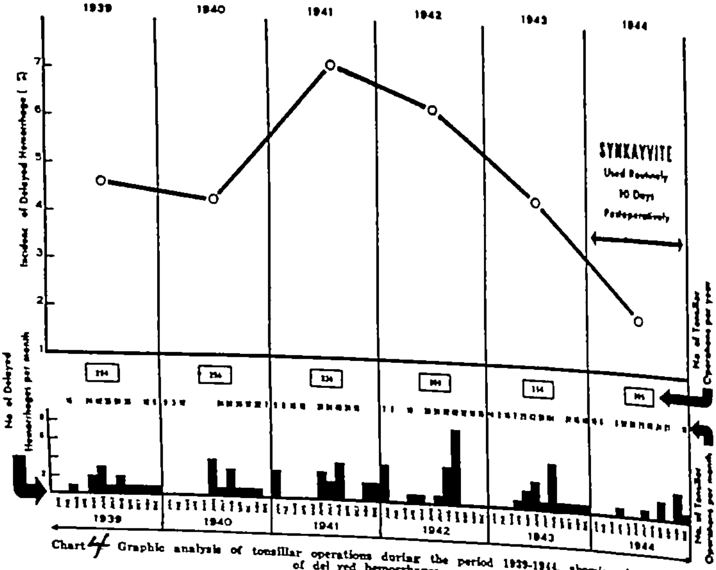


Chart 4 Graphic analysis of tonsillar operations during the period 1939-1944, showing incidence of del yed hemorrhages

Neivert has pointed out that acetyl salicylic acid in chewing gum may induce postoperative bleeding by some local effect on healing fossa In this case vitamin K would not be expected to control the tendency to bleed

More recent studies by Neivert, Pirk and Engleberg[6,7] have demonstrated that in 246 tonsillectomies, those patients with a postoperative subnormal plasma concentration of ascorbic acid had five times as many postoperative hemorrhages as those whose level was normal or above They presented evidence that vitamin C exerts a protective effect against salicylate induced hypoprothrombinemia, probably due to the vitamin's detoxifying effect seen these cases associated with delayed hemorrhages, following sudden increase in pain and rise in temperature. Infection is probably a very frequent cause of delayed bleeding, and McGovern[3] reports a decrease in his hemorrhages by the use of sulfathiazole chewing gum. He reported 150 cases of tonsillectomy with only two hemorrhages (1.3 per cent), a series too small to be conclusive.

In 1944, Neivert and his co-workers[4] corroborated previous studies showing that salicylates might cause hypoprothrombinemia. He concluded that aspirin was a major cause of post-tonsillectomy hemorrhages.

TABLE 3

INCIDENCE OF DELAYED HEMORRHAGES ENCOUNTERED AFTER TONSILLAR OPERATIONS IN THE YEARS 1939-1947

Without Synkavite medication			With Synkavite Medication		
Year	No of T & A	No of Late Hemorrhages	Year	No of T & A	No of Late Hemorrhages
1939	284	13	1944	385	8
			(no change of technique to this point)		
1940	256	11	1945	483	19
1941	226	16	1946	518	6
1942	303	19	1947	451	3
1943	354	16			
Total	1,423	75	Total	1,837	36
Incidence of delayed hemorrhage 5.2%			Incidence of delayed hemorrhage 1.95%		

In 1945, the author[5] presented a study of 1,808 cases of tonsillectomy performed during the period from 1939 to 1944, inclusive. Twenty-five immediate and 83 delayed hemorrhages were reported in this series. An average yearly incidence of 5.3 per cent delayed hemorrhages was reduced to 2.08 per cent when vitamin K (synkavite — Hoffmann-LaRoche) was given for 10 days postoperatively. Since that time, 1,452 cases have been studied, with 28 delayed hemorrhages. This reduces the percentage of bleeding from 5.27 per cent before the use of vitamin K to 1.95 per cent when vitamin K was used postoperatively.

In this work, an attempt was also made to correlate the hemorrhages with the time of year when infections are most prevalent The difference in the percentage of bleeding cases in winter months was only 1 per cent greater than those occuring during the summer months This would tend to minimize the importance of infection on tonsillar hemorrhage

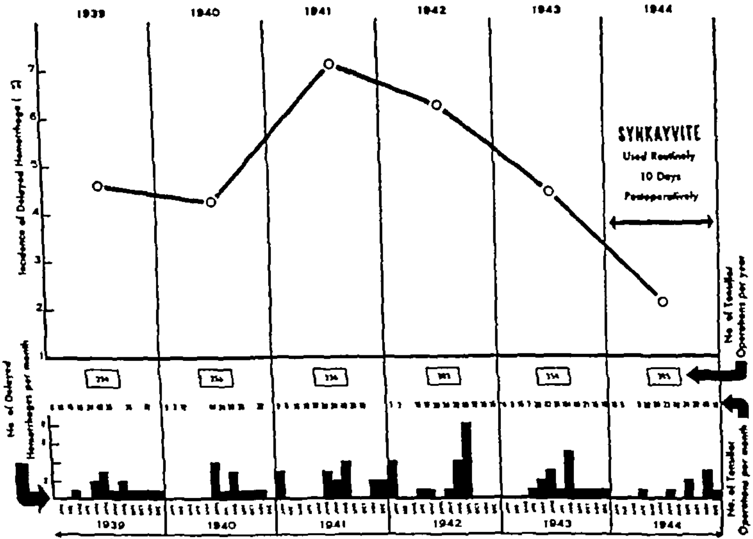


Chart 4 Graphic analysis of tonsillar operations during the period 1939-1944, showing incidence of delayed hemorrhages.

Neivert has pointed out that acetyl salicylic acid in chewing gum may induce postoperative bleeding by some local effect on healing fossa In this case vitamin K would not be expected to control the tendency to bleed

More recent studies by Neivert, Pirk and Engleberg have demonstrated that in 246 tonsillectomies, those patients with a postoperative subnormal plasma concentration of ascorbic acid had five times as many postoperative hemorrhages as those whose level was normal or above They presented evidence that vitamin C exerts a protective effect against salicylate induced hypoprothrombinemia, probably due to the vitamin's detoxifying effect

The author is now studying a series of tonsillectomy cases in which tablets containing ascorbic acid, mg 100, and synkayvite (Hoffmann-LaRoche, vitamin K), 5 mg, are being used pre- and postoperatively Too few cases have been observed (125 cases) to justify any conclusions at this time

Trauma has long been recognized as conducive to secondary hemorrhage in surgical procedures Torn and injured muscle fibres impede the normal dynamics of hemostasis by interfering with with contraction of vessel walls If the aponeurosis of the muscle is torn, less extravascular pressure can be built up when the blood spreads to the surrounding tissues Traumatized tissues, ragged edges and tags lend themselves to excessive granulation tissue and sloughing, and present better media for deep infection

TABLE 5 TYPE OF OPERATION AND APPLICATION OF TIES In 298 TONSILLAR PATIENTS

Total T & A Studied	Dissection Operation	Beck-Shenk Snare	No Ties Used	Ties Used	Sutures
298	165	133	235	62	1

Fishman and Lebo[8] (Mayo) recently presented a study of 341 cases of tonsillectomy followed by only 0 5 per cent postoperative hemorrhage In the absence of medication for the prevention of bleeding, and with the free use of aspirin, they conclude that lack of trauma, attending the use of the Beck snare, was responsible for this low incidence

During the past year the author has attempted to compare the occurrence of postoperative tonsil hemorrhage in cases in which dissection was employed with those in which the Beck type of instrument was used In all, 298 cases of tonsillectomy were studied as to the amount of bleeding at the time of operation, and to the relation of postoperative hemorrhage to the type of operation used, and the application of ties

Of the 298 cases, 165 were dissected and snared In 133 cases, the Beck type snare was used without dissection Little or no difference was noted in the amount of bleeding at the time of operation between the two methods No postoperative hemorrhages occurred in those cases in which the Beck type instrument was used While this series is too small to be conclusive, it is, nevertheless, suggestive

In the 451 cases operated upon in the year 1947, seven hemorrhages occurred Three of these, or 0 66 per cent, were delayed, and four, or 0 88 per cent, were immediate The total hemorrhages presented a percentage of 1 5 per cent

Of the seven hemorrhages occurring, two occurred in cases in which ties were applied This is suggestive that ties might add to the trauma and may provide excessive granulations which may ooze later

Other factors, such as suction in the tonsil fossa, or wiping the fossa with gauze, may remove a firm fibrin plug and enhance bleeding

Symptoms and Signs of Hemorrhage In adults, the signs of bleeding from the throat are evident, but in small children it might go unnoticed until large amounts of blood are vomited Pallor, sweating, restlessness, thirst and rapid pulse are systemic evidence of blood loss

If repeated swallowing occurs, in small children, it should be investigated and it often leads to the detection of early bleeding Also, we have noted that sudden increase in the amount of pain on one side of the throat often precedes impending bleeding

Prevention of Hemorrhage There is no known way to determine which case will have postoperative bleeding, however, a careful history should be taken in an effort to eliminate blood dyscrasias, recent throat infection and family tendencies to bleed A history of excessive bleeding following injury or tooth extraction, should lead to a careful blood study, including prothrombin time and platelet count We should expect more bleeding in cases with a history of high blood pressure, arteriosclerosis, recent rheumatic fever, etc

All of us have seen cases with rapid coagulation time bleed copiously, and others with a coagulatnon time bleed very little It seems wise, from every point of view, however, to do a determination of the coagulation or bleeding time just before the operation is to be done If the coagulation time is found to be more than eight minutes, 10 mg vitamin K should be given intramuscularly and usually the clotting time will be found to be decreased in an incredibly short time Also, in cases where preoperative sedation by barbiturates is used, vitamin K should be given

Ascorbic acid may be given in doses of 100 mg before meals, pre- and postoperatively Large amounts of citrus fruit should be taken postoperatively unless they increase the pain, in which case it is better to depend upon the tablets

Much has been written about the uselessness of giving calcium preoperatively, however, calcium deficiencies do occur rather frequently, especially in goiter belts, and their use routinely may be justified

Management of Hemorrhage Primary Gentle pressure with gauze sponges seems preferable to the many mechanical devices suggested in the past String sponges are useful in allowing the operator to proceed with the operation on the other tonsil, after removing one They may be left in the fossa for 10 to 12 hours if desired and usually control oozing It is seldom necessary to sew the pillars together

Hemostatic agents such as a solution of thrombin may help to produce a quick natural clot A solution should be made of such strength to suit the case and applied directly to the bleeding surface, by means of a sponge This is especially useful in adenoid bleeding Oxidized cellulose gauze or cotton may be packed into the postnasal space or tonsil fossa, but should be anchored by a string, so that the material is not aspirated

The use of astringents or sclerosing substances at the time of the operation should be condemned and gargles do more harm than good

Crushing the vessel mouth with forceps is preferable to ligatures or sutures and is usually all that is needed to complete hemostasis Trauma to adjacent tissues should be avoided by gentle, accurate clamping of the vessel alone, where possible

A well applied ligature is simple and preferable to suturing Suturing may be used where trauma is great and a large area bleeds copiously We have found suturing seldom necessary

Secondary Hemorrhage In addition to the above measure, secondary bleeding may require other special measures

Rest in bed and thorough sedation by morphia is usually sufficient to stop bleeding An ice collar may be used if comforting to the patient, and vitamin K should be given in larger doses

If the bleeding continues, it will be necessary to remove the clot, under which a vessel continues to ooze This is easily accomplished by ring, sponge forceps, and may alone be sufficient to stop bleeding It may be necessary to touch the bleeding area with a solution of thrombin or adrenalin, silver nitrate 50 per cent, Monsell's solution, tannic acid, chromic acid or other caustics

To inject a small amount of novocaine or adrenalin about the site of bleeding is a most useful and painless method of controlling hemorrhage

Occasionally these simple measures fail, and it becomes necessary to put a ligature or suture about the offending vessel We find that 2 per cent pontocaine applied locally or novocaine injected into the floor of the fossa greatly reduces the pain of this procedure Since the tissue is friable and difficult to tie, we prefer to use a small atraumatic needled supplied with catgut So little pain is incurred that it is seldom necessary to give general anesthesia, even to small children Restraint and a mouth gag are usually necessary to control children, but every effort to gain the patient's confidence and to reassure him is of equal importance

General supportive treatment such as glucose or proteins by infusions and transfusions of whole blood or plasma should be used early when much blood is lost

Management of Tonsillectomy Discussion of this phase of the subject is limited to the relation of management of tonsillectomy, to the prevention and control of hemorrhage It will be confined to and based upon the studies presented above More detailed discussions, such as the studies by Shambaugh or Jones,[9, 10] maye be referred to by those interested

Preoperative Management Patients who have had recent acute infections should not be subjected to tonsillectomy for from two to four weeks after recovery In addition, it may be wise to give these patients two days of treatment with suitable antibiotics immediately preceding the operation

If the history suggests bleeding, a complete blood study should be made Vitamin K in doses of 5 mg for children and 10 mg for adults should be given before meals and at bedtime, for one or two days preoperatively

Sedation with barbiturates and atropine prevents psychological shock in children, and morphia may be added for adults It should be remembered, though, that barbiturates may prolong the prothrombin time and that vitamin K will prevent this

Operative Management The type of anesthesia should be that safest in the hands of a given anesthetist It should be given over the shortest period of time consistent with careful surgery and complete hemostasis

The author has found that removal of the adenoids first has been the greatest single factor in reducing the trauma to the posterior pillar A sharp adenotome should be used with gentleness and stripping of the pharyngeal mucosa should be avoided While it is freely admitted that the use of the adenoid curette is subject to criticism, one often finds it indispensable to a thorough job, providing care and gentleness are used

Gentle palpation with the forefinger will reveal tags of infected lymphoid tissue remaining which tend to bleed if not removed

String sponges or gentle pressure with a sponge in the nasopharynx should be used to control bleeding Sponges, wet with a solution of thrombin, usually hasten hemostasis By whatever means necessary, hemostasis should be complete before the patient leaves the table

Regarding the method of removing the tonsils, one cannot emphasize too strongly that the method of choice is the one which the surgeon can use most quickly, thoroughly and with the least trauma Many tonsils are poorly adapted to the use of the Beck type instrument, in which case dissection may be the method of choice In our studies, we feel that less delayed bleeding follows the use of the Beck type of instrument, probably due to diminished trauma The Beck instrument should be followed by the snare to remove the tissue at the lower pole of the tonsil fossa

Vitamin K in doses of 5 mg for children and 10 mg for adults is given with or without ascorbic acid before meals and at bedtime for 10 days after the operation

Vitamin K is often given intramuscularly and helps control persistent oozing in the fossa while the patient is on the table

Aspirin gr V, or Aspergum, is given before meals and at bedtime if required, but patients are cautioned not to use it in excess

Sulfonamides and penicillin are used freely, if infection is anticipated, and sulfathiazole chewing gum may be especially useful in these cases

A few concisely written instructions are provided for each patient to guide his convalescence They may be varied to suit a given case, and we submit the one used by us, as it is brief and has proven satisfactory These prepared instructions save much time and explanation to patients

By adhering to these few simple measures, we have been able to reduce the incidence of postoperative tonsil hemorrhage on an average of 5 3 per cent in the years of 1939 to 1944, to

TABLE 6 POSTOPERATIVE ORDERS FOR TONSIL PATIENTS

Rest in bed three or four days Purgative (mild) tonight Aspirin or Aspergum in as small amounts as possible to keep reasonably comfortable Before meals and at bedtime should be enough Aspirin promotes hemorrhage

Soft and liquid diet few days—anything can swallow Insist on nourishment being taken Take vitamin K tablets as prescribed

In case of bleeding, take more vitamin K Rest quietly Be calm and come to the hospital

an average of 0 88 per cent for delayed, and 1 7 per cent for all bleeding in the years of 1946 and 1947

SUMMARY

1 A brief resumé of the physiology and dynamics of hemostasis is given

2 A study of 3,260 cases of tonsillectomy is presented to emphasize certain etiological factors of postoperative hemorrhage

3 A brief survey of the diagnosis and management of hemorrhage is discussed

4 A general plan of management of the operation of tonsillectomy is suggested for the reduction of the postoperative tonsil bleeding

BIBLIOGRAPHY

1 Sharp and Dohme Seminar, May 1947

2 Tocantins, L M *Ann Surg*, 124 293 1947

3 McGovern *Arch Otolaryngol* 40 196 197, Sept, 1944

4 Neiver Late Secondary Hemorrhages *Arch Otolaryngol*, 42 14-18 July, 1945

5 Preston, H G *Va Med Jour* 73 252 256 June 1946

6 Neivert Pirk and Engleberg Late Secondary Tonsillar Hemorrhage Studies of Ascorbic Acid *Arch Otolaryngol*, 43 568 577, June 1946

7 Neivert Pirk and Engleberg Contributions to the Etiology Prevention and Treatment of Hemorrhage in the Field of Rhinolaryngology To be published in *Practica Oto Rhino Laryngologica*

8 Fishman and Lebo *Bull Prac Ophth*, *Green s Eye Hosp*, 17 1 July 1947

9 Shambaugh, G E Technique of Tonsillectomy and Adenoidectomy *Clin N Am* 22 237 252 Feb 1942

10 Jones, Edley H The Mississippi Doctor pp 65 71 July 1947

THE EFFECT OF THE L-EPHEDRINE SALT OF PENICILLIN G (TERSAVIN*) ON THE BACTERIAL FLORA OF THE NASAL MUCOSA†

E. GRUNBERG, Ph.D., and E. H. TITSWORTH, B.S.,
Nutley, N. J.

In an interesting paper by Everett,[1] it has been shown that sodium sulfathiazole, particularly in combination with dl-desoxyephedrine as a vasoconstrictor, was superior to penicillin in the treatment of infected sinuses. This is surprising because of the superior antibacterial activity of penicillin towards the Gram-positive and Gram-negative cocci, which in Everett's investigations were also found to be the most common causative agents of sinus infections. It suggests that the presence of the vasoconstrictor plays an important rôle in the successful treatment of inflammatory infectious processes of the nose. Mixtures of penicillin and vasoconstrictors are apparently widely used and of satisfactory activity.[2] For that reason, a series of investigations was recently carried out in which the antibacterial effects of an l-ephedrine salt of penicillin G were examined both clinically[3] and experimentally.[4]

The l-ephedrine salt of penicillin G, synthesized by Dr. M. W. Goldberg and Mr. S. Teitel, of the Roche Chemical Laboratories, is a compound which combines in one molecule the vasoconstrictory properties of ephedrine and the antibacterial activity of penicillin G. Studies on the pharmacology and chemotherapeutic effects of this compound have been published elsewhere.[4] These investigations have shown that, due to the presence of the vasoconstrictor, the absorption from the site of administration was delayed and consequently the

---

*Tersavin—T. M.—Reg. U. S. Pat. Off.

†From the Department of Chemotherapy, Hoffman-La Roche Inc., Nutley, N. J.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Jan. 8, 1949.

topical prophylactic antistreptococcal activity was superior to that of other water-soluble penicillin salts.

It was the observation on the topical activity of Tersavin that suggested the usefulness of this penicillin derivative for topical administration on infected tissues and surfaces. The favorable physical properties of this compound, namely the high solubility, the absence of disturbing color and the innocuousness for tissues, were considered additional factors which encouraged the use of this material on mucus surfaces inhabited by a normal and occasionally pathologic flora. As an easily available test object for the determination of the activity of this penicillin salt on a bacterial infected mucus surface, the nasal mucosa was selected. The studies were conducted on volunteers with a supposedly normal nasal flora (*i.e.*, people without actual acute or chronic nasal disturbances), as well as on patients of an ear, nose and throat clinic.

MATERIALS AND METHODS

Two tablets of Tersavin, containing 30,000 units penicillin/tablet, were dissolved in 15 ml of distilled water or saline so that a concentration of 4,000 units penicillin/ml was obtained. With the cooperation of Dr. Reginald Everett, St. Luke's Hospital, New York, N. Y., nasal swabs were obtained from patients immediately before treatment and streaked on blood agar plates containing 1 mg penicillinase/ml. Twenty minims of the Tersavin solution were then instilled into the nostril from which the initial swab had been obtained. At various intervals after treatment, swabs were taken and streaked on penicillinase (1 mg/ml) blood agar plates so that any residual penicillin would be inactivated.

Grubb and Puetzer's[5] criticism of the swab technique, namely, that the bacterial flora picked up by the swab at the vestibule of the nares might have insufficient contact with the penicillin is indeed justified. In our use of the swab method, the decrease in the flora after Tersavin therapy was so striking that even this interference could be disregarded; therefore, the swab technique was used throughout our experiments.

EXPERIMENTAL RESULTS

The flora obtained in the present cases were usually *Staphylococcus aureus* and *Staphylococcus albus* In a few patients, hemolytic streptococci were isolated The initial cultures, which were taken before treatment with Tersavin, showed innumerable colonies in the majority of cases Less than 500 colonies could be counted in those cases where reduction in the nasal flora was seen Frequently a reduction to less than 100 colonies and occasionally no visible growth was observed in these experiments

The per cent of cases which showed a reduction in the nasal flora 15 minutes to four hours after one treatment, three hours after three treatments at two-hour intervals, and three to four hours after three treatments on one day and the fourth treatment on the following morning are given in Table 1 In all cases, a minimum of 70 per cent of those treated showed a reduction in the nasal flora

TABLE 1 EFFECT OF TERSAVIN ON NORMAL AND PATHOLOGIC NASAL FLORA.

Subculture on Blood Agar Plate + 1 Mg/Ml Penicillinase

No of Cases	No of Treatments	Interval	No of Patients Showing Reduction in Nasal Flora	% Patients Showing Reduction in Nasal Flora
13	1	15 min.	9	70
6	1	1 hour	6	100
3	1	4 hours	2	66
20	3	3 hours	15	75
12	4	3-4 hours	11	92

In order to use the more sensitive method of liquid medium for the question of the reduction of nasal flora, some of the swabs taken three to four hours after treatment were put into broth and incubated A striking example of the results obtained is given in Fig 1 The tube, 133A, which is perfectly clear, indicates the inoculation of the swab after therapy with Tersavin, while 133B, which is highly turbid, was taken before the administration of Tersavin The swabs, put into the test tubes, are still visible in the photograph

Even after longer intervals between the last treatment and the taking of a final culture, a significant reduction in the nasal flora may be seen Three cases in which the subculture period ranged from 11 to 20 hours after the last treatment of repeated doses showed a considerable reduction Fig 2 is from a case of a known carrier of hemolytic *Staphylococcus* *aureus* who suffered from relapsing boils of the nares After the initial cultures, the patient instilled 20 minims of the Tersavin solution two to four times daily in both nostrils for four days On the morning of the fifth day, about 20 hours after the last administration of Tersavin, swabs were again taken from both nostrils The number of colonies were innumerable before treatment, but after therapy were reduced to 340 colonies for the right and 92 colonies for the left nostril

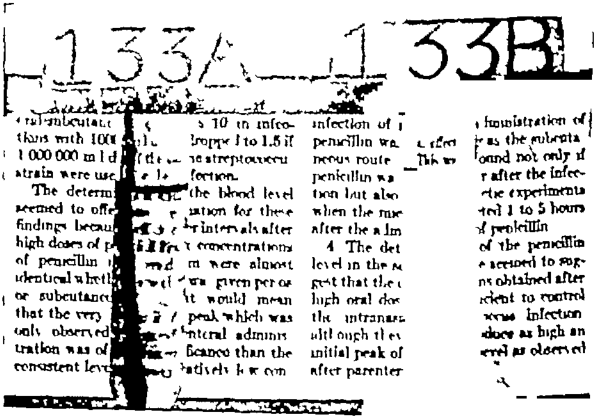


Fig 1 Growth in broth of nasal swabs taken before and three to four hours after treatment with Tersavin

These results clearly demonstrate the fact that local Tersavin therapy is able to reduce the bacterial flora on a mucus surface, moreover, the reduction of the nasal flora lasted for a period far beyond that time within which penicillin might be expected to remain in living tissue This observation was not surprising to us since an earlier publication by Grunberg, Schnitzer and Unger[6] had shown that, although no detectable penicillin could be observed in tissues two hours after a topical penicillin treatment, a sufficient amount was adsorbed on the bacteria to exert an effect for a considerably longer period of time

In an attempt to further analyze these findings, Grunberg and Unger[7] employed Fleming's gutter plate method, in order to show that pathogenic organisms, in this case *Streptococcus hemolyticus,* showed an increased sensitivity to extremely small amounts of penicillin It was assumed that this was due to an additive effect of the penicillin which diffused into the agar plus that residual penicillin specifically adsorbed to the surface of the organisms It was, therefore, attempted to demonstrate a similar increased sensitivity of bacteria towards penicillin after treatment of the nasal mucosa with Tersavin by a series of experiments in which swab cultures of the treated mucosa were plated on blood agar plates containing a noninhibitory dose of penicillin A group of volunteers were, therefore first examined in order to find out which concentration of penicillin in the blood agar allowed full growth of bacteria and which one was sufficient to inhibit growth completely The results are given in Table 2

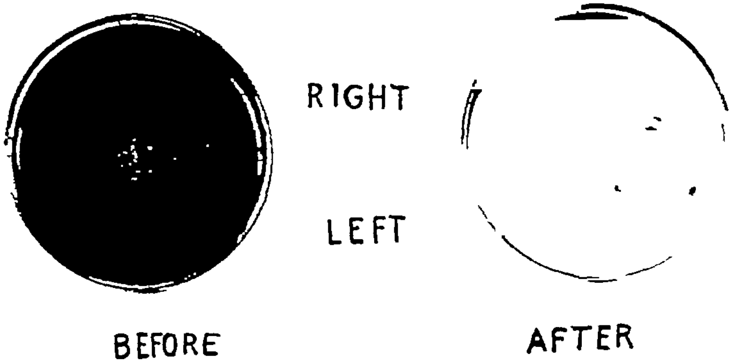


Fig 2 Nasal flora before and 20 hours after four days treatment with Tersavin.

TABLE 2 SENSITIVITY OF THE NASAL FLORA TO PENCILLIN G INCORPORATED INTO BLOOD AGAR PLATES

Volunteer Initials	Penicillin Concentration in the Agar (mcg/ml) 0 0006	0 006	0 06	0 3
D R	+++(a)	++	5 col	0
B L	—	—	0	0
A D	+++	+++	0	0
M D	—	—	0	0
E G	++	++	2 col	0
D K	+++	60 col	1 col	0
R S	+++	+++	6 col	4 col
W H	+++	+++	—	—

(a) +++ = heavy growth of innumerable colonies
++ = lighter growth colonies still innumerable
— = not tested

It may be seen from Table 2 that in the majority of cases a concentration of 0 006 mcg penicillin/ml or less did not interfere with heavy growth of the nasal staphylococcus flora, while concentrations of 0 06 mcg/ml and more allowed only the development of very few colonies, in most cases there was no growth at all

Considering these results, 0 003 mcg penicillin G/ml was chosen as the noninhibitory dose for demonstrating the increased sensitivity of the nasal flora after Tersavin treatment The results are given in Table 3

TABLE 3 GROWTH OF NASAL FLORA ON BLOOD AGAR CONTAINING PENCILLIN G 0 003 MCG/ML BEFORE AND AFTER A SINGLE ADMINISTRATION OF TERSAVIN (4,000 U/ML)

Exp No	Volunteer Initials	Before	Number of Colonies After 8	16	24	40 Hours
E 184	R S	inn (a)	87	—	300	—
	D K	inn	20	—	40	—
E 183	R S	650	—	76	45	400
	A D	900	—	425	53	210

(a) inn = innumerable

It is evident from these experiments that after 24 hours, and to a certain degree after 40 hours, only a small fraction of the surviving nasal flora was able to grow in the presence of an noninhibitory concentration of penicillin which allowed good growth of the nasal flora before treatment These experiments substantiate the fact that the growth of staphylococci from the nasal mucosa after treatment with Tersavin is inhibited by very small concentrations of penicillin incorporated into the agar The concentrations *per se* are not sufficient to influence the growth of the nasal flora without pretreatment with Tersavin

The findings also appear to be interesting from the point of view of the possible development of a specific drug resistance induced by the use of a topical treatment of a penicillin salt It has recently been shown that chemotherapeutic agents, particularly streptocomycin[8] and to a lesser degree penicillin,[9] selectively affect individual bacteria of high sensitivity, while the more resistant individuals of the same population may survive and give rise to the development of resistant strains Such a selective survival of micro-organisms of abnormally increased resistance has not been observed so far either in our experimental work on artificial infections of mice or in our work with the flora of the nasal mucosa This was shown by the use of culture medium containing high concentrations (0 06 mcg/ml) of pencillin which in no case allowed the growth of organisms after the administration of Tersavin The development of drug resistance *in vivo* seems, therefore, to follow other rules than those suggested by *in vitro* experiments This is also shown in older studies by Schnitzer[10] and in the more recent investigations by Gezon and Collins [11]

DISCUSSION

The studies presented in this paper form a confirmation of previous experimental studies in infected tissues of animals and demonstrate that the topical administration of Tersavin significantly decreases the bacterial flora of the normal and diseased nasal mucosa for a considerable length of time Evidence is also presented that the antibacterial effect of the treatment lasts for a longer period of time than penicillin can be expected to be present in a detectable concentration An explanation for this phenomenon was attempted by demonstrating that the surviving individuals of the bacterial population showed an increased sensitivity towards penicillin

We are aware of the fact that these observations, which have been partly carried out in healthy volunteers, might not have an immediate significance for clinical problems The fact that it is possible by simple instillation of a vasoconstrictory ephedrine salt of penicillin to reduce the nasal flora might, however, have implications of a clinical therapeutic nature in acute or chronic diseases of the nose The results seem to indicate that Tersavin might be of value in other infectious processes of the nasal accessory sinuses where a direct influence on the viability of pathogenic micro-organisms is more to be desired than might be the case with the physiological flora of the mucus surface of the nose

SUMMARY

Experimental data are submitted to show that Tersavin, the l-ephedrine salt of penicillin G, significantly decreases the bacterial flora of the normal and diseased nasal mucosa for a considerable length of time In addition, the flora exposed to Tersavin treatment develops an increased sensitivity towards noninhibitory doses of penicillin The results obtained on the experimental model of the nasal flora might indicate a similar therapeutically valuable effect on the pathological flora of infected nasal accessory sinuses

REFERENCES

1 Everett, A R Local Use of Penicillin and Sulfathiazole for Acute and Chronic Sinusitis *Arch Otolaryngol*, 44 468 1946

2 Woodward, F D, and Holt T Local Use of Penicillin in Infections of the Ear, Nose and Throat *Jour A M A*, 129 589, 1945

3 Everett, A R Importance of Vasoconstriction in the Treatment of Acute and Chronic Maxillary Sinusitis *N Y State Jour Med*, in press

4 Grunberg E Randall, L O, and Schnitzer, R J The Chemotherapeutic and Pharmacological Properties of the L-Ephedrine Salt of Penicillin G (Tersavin) *Jour Pharmacol and Exper Therap*, in press

5 Grubb, T C, and Puetzer, B A Method for Counting Bacteria in the Nasal Cavity *Jour Lab and Clin Med*, 32 566 1947

6 Grunberg E Schnitzer, R J and Unger, C Mechanism of the Topical Effect of Penicillin G in Experimental Local Streptococcal Infections *Yale Jour Biol and Med* 20 479, 1948

7 Grunberg, E, and Unger C The Sensitivity of Streptococci to Penicillin G After Exposure to the Antibiotic *in Vivo* *Yale Jour Biol and Med* 21 121, 1948

8 Klein, M. and Kimmelman, L J The Rôle of Spontaneous Variants in the Acquisition of Streptomycin Resistance by the Shigellae *Jour Bact* 52 471 1946

9 Demerec M Origin of Bacterial Resistance to Antibiotics *Jour Bact*, 56 63 1948

10 Schnitzer, R J The Mode of Action of Bactericidal Chemotherapeutic Agents Medicine in Its Chemical Aspects Reports from the Medico-Chemical Research Laboratories of the I G Farbenindustrie Aktiengesellschaft, Bayer Leverkusen Germany 1938 pp 32

11 Gezon H M, and Collins G R Antibiotic Studies on Beta Hemolytic Streptococci IV—Penicillin Resistance Induced in Mice and Embyronated Eggs *Proc Soc Exper Biol and Med* 69 312 1948

CENTRAL ILLINOIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

On Nov 12, 13 and 14, 1948, the Central Illinois Society of Ophthalmology and Otolaryngology held their eleventh meeting at the Abraham Lincoln Hotel in Springfield, Ill Dr F Bruce Fralick, professor of ophthalmology at the University of Michigan, spoke on "Surgical Anatomy of Operations for Glaucoma" and "Diseases of the Tear Duct" Dr F L Lederer, professor and head of the Department of Otoloryngology, University of Illinois, discussed "Modern Approaches to the Prevention and Treatment of Defective Hearing" and "Malignancy in Its Relationship to Nasal Obstruction and Hoarseness" Dr L W Roth, Belleville, Ill, gave a paper on the "O'Connor Cinch Operation," and Dr D K. Judd, of Kankakee, Ill, discussed "Malignancies of the Paranasal Sinuses" Thomas W Samuels, an attorney from Decatur, Ill, gave a delightful talk on "A Lawyer Looks at the Medical Profession" The following officers were elected for 1949 President, Dr Clifton S Turner, Peoria, Ill , President-elect, Dr Harold Watkins, Bloomington, Ill , Vice-President, Dr Meredith Ostrom, Rock Island, Ill , Secretary-Treasurer, Dr Philip R McGrath, Peoria, Ill

CLINICAL STUDY OF VONECIDIN*†

L CALVIN DAVIS, M D ,

Omaha, Neb

The therapeutic aims of local medication in the management of rhinological conditions are to reduce congestion of the nasal mucosa, to promote or restore ciliary function and to control secondary bacterial invasion

The most desirable and widely useful single drug for accomplishing the first of these aims is the nasal decongestant The ideal medication of this type must provide effective and prolonged vasoconstriction without disturbing the normal physiology of the nose, it should be nonirritating and devoid of local and systemic side-effects, and it should not cause secondary or rebound congestion and turgescence of the nasal tissues

Vonedrine solution has been shown, pharmacologically and in clinical rhinological practice, to possess certain advantages over nasal decongestants in common usage

Chemically, Vonedrine is phenylpropylmethylamine, a secondary amine It forms salts readily with mineral acids which are stable and do not decompose on storage under ordinary conditions of exposure The hydrochloride is a white crystalline salt with a melting point of 114° C It is very soluble in water and alcohol, slightly soluble in acetone, and insoluble in benzene, chloroform and ether The solution for intranasal use is isotonic

Vonedrine exerts its essential therapeutic action on the deep vascular plexus, which is the objective in decongestant therapy This network of blood vessels controls the thickness of the tissues over the turbinates, and by decreasing the blood

---

*Read at the meeting of the Nebraska College of Medicine Lincoln Neb April 3 1949

†From the Department of Otolaryngology, University of Nebraska College of Medicine

Editor's Note This ms received in Laryngoscope Office and accepted for publication Jan 10 1949

through vasoconstriction the swollen turbinates shrink and the capacity of the airway is increased Constriction of the superficial blood vessels, on the other hand, would result only in blanching of the mucosa, causing a local ischemia which obscures the actual degree of inflammatory mucosal reaction and disturbs nasal physiology

Because of the characteristic action of Vonedrine—effective decongestion without blanching—topical application or inhalation into the nose does not produce stinging or burning The onset of vasoconstriction is not quite so rapid as that of certain other nasal decongestants but the degree of congestion is equally as great and the period of decongestion is of longer duration The use of Vonedrine is not followed by rebound secondary congestion or turgescence The initial vasoconstricting action of Vonedrine is more physiological and not so intense as is that of many other decongestants, and since the secondary congestion which usually attends the use of nasal vasoconstrictors is directly proportional to the intensity of the primary effect, there is little likelihood of local secondary congestion or undesirable systemic side-actions

The pharmacological and toxic effects of Vonedrine were studied and compared with those of l-ephedrine and amphetamine[1] The effect of Vonedrine on the cardiovascular system and the bronchioles is very similar, both quantitatively and qualitatively, to that of amphetamine, however, it produces very little, if any, central stimulation in the experimental animal Warren and Werner,[2] in a comparative study of the central stimulating action of seven commercial vasopressor amines used as nasal decongestants, found that Vonedrine had no effect at the lowest dose level and only slight effect at the highest level The toxicity of Vonedrine is of the same order as l-ephedrine and about one-half that of amphetamine[1]

Vonedrine solution was originally supplied for clinical investigation in 0 5 per cent concentration of Vonedrine Levulinate Baumgardner and co-workers,[3] based on their study of 150 rhinological patients, reported this to be an effective nasal

CLINICAL STUDY OF VONECIDIN [*][†]

L CALVIN DAVIS, M D ,
Omaha, Neb

The therapeutic aims of local medication in the management of rhinological conditions are to reduce congestion of the nasal mucosa, to promote or restore ciliary function and to control secondary bacterial invasion

The most desirable and widely useful single drug for accomplishing the first of these aims is the nasal decongestant The ideal medication of this type must provide effective and prolonged vasoconstriction without disturbing the normal physiology of the nose, it should be nonirritating and devoid of local and systemic side-effects, and it should not cause secondary or rebound congestion and turgescence of the nasal tissues

Vonedrine solution has been shown, pharmacologically and in clinical rhinological practice, to possess certain advantages over nasal decongestants in common usage

Chemically, Vonedrine is phenylpropylmethylamine, a secondary amine It forms salts readily with mineral acids which are stable and do not decompose on storage under ordinary conditions of exposure The hydrochloride is a white crystalline salt with a melting point of 114° C It is very soluble in water and alcohol, slightly soluble in acetone, and insoluble in benzene, chloroform and ether The solution for intranasal use is isotonic

Vonedrine exerts its essential therapeutic action on the deep vascular plexus, which is the objective in decongestant therapy This network of blood vessels controls the thickness of the tissues over the turbinates, and by decreasing the blood

---

[*] Read at the meeting of the Nebraska College of Medicine Lincoln Neb April 3 1949

[†] From the Department of Otolaryngology University of Nebraska College of Medicine

Editor's Note This ms received in Laryngoscope Office and accepted for publication Jan 10 1949

through vasoconstriction the swollen turbinates shrink and the capacity of the airway is increased Constriction of the superficial blood vessels, on the other hand, would result only in blanching of the mucosa, causing a local ischemia which obscures the actual degree of inflammatory mucosal reaction and disturbs nasal physiology

Because of the characteristic action of Vonedrine—effective decongestion without blanching—topical application or inhalation into the nose does not produce stinging or burning The onset of vasoconstriction is not quite so rapid as that of certain other nasal decongestants but the degree of congestion is equally as great and the period of decongestion is of longer duration The use of Vonedrine is not followed by rebound secondary congestion or turgescence The initial vasoconstricting action of Vonedrine is more physiological and not so intense as is that of many other decongestants, and since the secondary congestion which usually attends the use of nasal vasoconstrictors is directly proportional to the intensity of the primary effect, there is little likelihood of local secondary congestion or undesirable systemic side-actions

The pharmacological and toxic effects of Vonedrine were studied and compared with those of l-ephedrine and amphetamine[1] The effect of Vonedrine on the cardiovascular system and the bronchioles is very similar, both quantitatively and qualitatively, to that of amphetamine, however, it produces very little, if any, central stimulation in the experimental animal Warren and Werner,[2] in a comparative study of the central stimulating action of seven commercial vasopressor amines used as nasal decongestants, found that Vonedrine had no effect at the lowest dose level and only slight effect at the highest level The toxicity of Vonedrine is of the same order as l-ephedrine and about one-half that of amphetamine[1]

Vonedrine solution was originally supplied for clinical investigation in 0 5 per cent concentration of Vonedrine Levulinate Baumgardner and co-workers,[3] based on their study of 150 rhinological patients, reported this to be an effective nasal

The antibacterial action of Vonecidin was compared to two similar preparations containing tyrothricin Tests were made in the presence of 10 per cent serum It was found that Vonecidin had a somewhat better effect, and this was attributed to the synergistic action of the detergent germicide, Ceepryn Chloride, and the chemically modified antibiotic, Methacidin

The self-sterilizing properties of Vonecidin were studied by Taylor and Foter They contaminated the solution with individual organisms and with nasal secretions A saline solution was used as a control After 10 and 60 minutes, it was found that bacteria and fungi were practically eliminated in the Vonecidin, whereas they were thriving in large numbers in the saline controls

The proved clinical efficacy of Vonedrine and the low toxicity and high antibacterial action of Methacidin indicated Vonecidin to be a safe and effective intranasal medication

For the past year, this preparation has been used in 750(?) patients as adjunctive treatment for acute nasopharyngitis, acute colds, and maxillary, frontal, ethmoid and sphenoid sinusitis The mode of use was by nasal packs and spray, after which patients received infrared heat for 15 to 20 minutes Average duration of treatment varied from three to 10 days *A number of patients had repeated treatments* on recurrence of the condition

In all cases there was relief of congestion and the condition seemed to clear more rapidly than when the nasal solution without the antibacterial agent was used No patient complained of smarting and burning, and objectively there was no irritation No objective signs of tissue irritation were noted Patients preferred this medication to that formerly employed There was no nervousness nor increase in pulse rate or blood pressure in any of this series

Occasionally, Vonecidin was used as a lavage of an acute maxillary sinusitis The solution was introduced into the sinuses, and then withdrawn After removal of the solution and discharges, 5 cc of Vonecidin were injected into each sinus There was no complaint of smarting or burning

Recently, Seydell and McKnight[5] reported a disturbance of olfaction resulting from the intranasal use of tyrothricin, evidenced as parosmia and anosmia, which persisted over a period of months We have noted no disturbance in olfaction from Vonecidin This may be due to the chemically modified antibiotic, Methacidin, present in Vonecidin, which is less toxic than tyrothricin It also does not contain the hemolytic component of tyrothricin, namely, tyrocidin

Summary Vonecidin, an intrasanal solution containing a decongestant, a detergent germicide and a chemically modified antibiotic, has been used in 750 patients suffering with acute nasopharyngitis, acute colds and sinusitis

All patients were relieved There was no burning or irritation or secondary congestion, and in no case was there any nervousness or pressor action from the vasoconstrictor There apparently was quicker clearing of the condition than when the nasal solution without the antibiotic agent was used

There was no disturbance in olfaction

BIBLIOGRAPHY

1 Warren M R Marsh, D G Thompson C R Shelton R S and Becker T J Pharmacological Studies on dl Phenyl n Propylmethylamine a Volatile Amine *Jour Pharmacol and Exper Therap*, 79 187 199, 1943

2 Warren, M R and Werner, H W The Central Stimulant Action of Some Vasopressod Amines *Jour Pharmacol and Exper Therap*, 85 119 121 1945

3 Bumgardner, J S Abernathy L D and Zimmerman F B Vonedrine (Phenylpropylmethylamine) Clinical Study of a New Nasal Decongestant The Laryngoscope 54 408-420 1944

4 Taylor B and Foter, M J Bacteriological Studies on a Nasal Decongestant Containing the Antibiotic Methylol-Gramicidin The Laryngoscope, 58 1206 1215 Nov 1948

5 Seydell E M and McKnight W F Disturbances of Olfaction Resulting from Intranasal Use of Tyrothricin *Arch Otolaryngol* 47 465 470 1948

THE CENTRAL STIMULANT ACTION OF SOME COMMERCIAL NOSE DROP PREPARATIONS*

M K McPhail, Ph D,†
Flushing, N Y

An essential ingredient of most nose drop preparations is a pressor amine which induces shrinkage of the nasal passages by a local vasoconstrictor effect Apart from this effect, many of the commonly used pressor agents cause stimulation of the central nervous system which, although beneficial in numerous clinical conditions, is a disadvantage in nose drops and in other preparations employed for a purely local effect A search of the literature failed to reveal any reports on the comparative central stimulant action of different commercial nose drop preparations, and it was with this study in mind that the present work was undertaken Warren and Werner (1945) studied the activity of rats following subcutaneous administration of seven pressor amines given in doses equal to fractional parts of the LD50 Our work differs from theirs in that the nose drops were added intranasally at repeated intervals This method of administering nose drops for comparative testing, although open to the criticism that it is less accurate than parenteral injection, so far as dosage is concerned, is more logical since it parallels exactly the route by which the drops are taken therapeutically

In addition to the above, studies were also made on the central stimulation of the commercial nose drop preparations following their intraperitoneal injection

METHODS

a Central Stimulation The technique employed for record-

---

*Research Laboratories of the Vick Chemical Co Flushing N Y

†The author acknowledges the technical assistance of T H Wombolt

Editor's Note This ms received in Laryngoscope Office and accepted for publication Jan 23 1949

ing central stimulation was essentially that of Schulte and co-workers (1941), with one important modification It had been our experience that the sensitivity of the work adders varied with the setting of the adjustment screws into the axle, owing to differences of pressure, and it was possible that their sensitivity varied from day to day, or even during the course of an experiment To overcome this difficulty the following changes were made the adjustment screws were eliminated, two ball bearings were inserted over the axle, and recessed into the wheel of the work adder, and two thrust bearings were placed on either side of the movable lever With these improvements the instruments were made more sensitive and their performance more constant

b Animals Adult male and female rats, fed Purina laboratory chow supplemented with greens in season, were employed in these experiments All tests were made on four groups of 10 rats each

c Procedure The test chamber was fitted with 10 cages so that 10 animals were treated at one time, five of which were given the test solution and five the control solution On the following day or, in some instances, two or three days later, the experiment was repeated with the same animals in the same cages, but with the solutions reversed By this arrangement a "crossover" test was performed and values for the difference between the effect of the test and control solutions were calculated The volume of solution administered to each rat was 0 7 cc and this was given either as a single injection (intraperitoneally), or as seven divided doses of 0 1 cc each (intranasally) given at 10-minute intervals, since the rats did not accept more than 0 1 cc applications without undue loss of the material Following drug administration, the animals were put into the test chamber and allowed a 15-minute adjustment period, after which the kymograph was started and activity recorded for six hours The average activity of at least 10 animals was recorded for each test, although in some tests 20 and 30 animals were used

Most of the experiments were carried out at a temperature of 27° to 29° C In very hot weather the air in the test chamber was cooled by passing it through a coil in ice but, even so, the temperature on two occasions increased during a test from an initial temperature of 29° to 33° C at the end of the experiment

Apart from the one exception noted, the nose drop preparations studied in these investigations were purchased on the open market These were Nose drop A (0 3 per cent ephedrine in mineral oil) , Nose drop B (0 5 per cent ephedrine in mineral oil) , Privine (0 1 per cent 2[α-naphthylmethyl] imidazoline hydrochloride] , Tuamine (2 per cent dl-2 aminoheptane sulfate) , Neo-Synephrine (1 per cent 1[m-hydroxyphenyl]-2-methylaminoethanol hydrochloride) Nose drop C, an aqueous isotonic buffered solution containing 0 5 per cent ephedrine sulfate, 0 04 per cent cetyl trimethyl ammonium bromide and 0 25 per cent chlorobutanol, was prepared in the laboratory The control solution for the aqueous preparations was 0 9 per cent saline and for the oily preparations light mineral oil These were administered in a manner and volume similar to that used for the experimental animals

RESULTS

a Intranasal Administration A summary of the results of the tests on intranasal administration of nose drops is given in Table 1, with two examples of the crossover test in Table 2 It is to be noted that Privine, at the dosage used, caused definite central stimulation, whereas none of the other nose drop preparations did That Neo-Synephrine and Tuamine were without effect is not surprising, as these agents are well known to be weak central stimulants, but that the three preparations containing ephedrine should prove to be without action was of considerable interest

b Intraperitoneal Administration Since Privine had proved stimulating when given intranasally, but not nose drops containing ephedrine, it was decided to study the action of these agents when injected intraperitoneally to see if the route of administration had a bearing on the result It was

TABLE 1 THE TOTAL ACTIVITY OF RATS FOLLOWING THE INTRANASAL ADMINISTRATION OF 0 7 CC OF VARIOUS COMMERCIAL NOSE DROP PREPARATIONS AND CONTROL SOLUTIONS (CROSSOVER TESTS)

Exper No	No of Rats Used	Revolutions of Work Adder Exper and Control Animals		Ratio of Revolutions Exper /Control	't' Value and Significance	
1	20	Privine (0 1%)	172	1 39	2 91	H S*
	20	Saline	123			
2	30	Nose drop A (ephed 0 3%)	232	0 92	0 18	N S†
	30	Mineral oil	251			
3	30	Nose drop B (ephed 0 5%)	213	1 15	1 02	N S
	30	Mineral oil	222			
4	30	Nose drop C (ephed SO_4 0 5%)	278	1 19	1 82	N S
	30	Saline	233			
5	29	Neo Synephrine (1%)	202	1 02	0 21	N S
	29	Saline	197			
6	20	Tuamine (2%)	107	0 87	1 01	N S
	20	Saline	123			

*H S = highly significant †N S = not significant —

TABLE 2† CROSSOVER TEST ON 20 RATS GIVEN PRIVINE AND SALINE, AND 30 RATS GIVEN NOSE DROP A AND MINERAL OIL ANIMALS STUDIED IN GROUPS OF 10

No of Animal	Rev of Work Adder		Difference† P-S	Rev of Work Adder		Difference† A-M O
	Privine	Saline		Nose Drop A	Min Oil	
1	6	4	+ 2	3	4	— 1
2	12	6	+ 6	15	8	+ 7
3	18	18	0	2	1	+ 1
4	9	10	— 1	45	33	+12
5	5	5	0	4	2	+ 2
6	9	4	+ 5	0	0	0
7	5	2	+ 3	0	1	— 1
8	11	12	— 1	24	26	— 2
9	7	6	+ 1	2	2	0
10	18	12	+ 6	3	5	— 2
11	3	1	+ 2	2	4	— 2
12	11	6	+ 5	3	8	— 5
13	2	1	+ 1	0	1	— 1
14	26	11	+15	12	17	— 5
15	4	2	+ 2	11	8	+ 3
16	0	0	0	1	1	0
17	1	1	0	1	1	0
18	20	17	+ 3	6	12	— 6
19	3	1	+ 2	2	2	0
20	2	4	— 2	3	3	0
21				4	3	+ 1
22				9	2	+ 7
23				4	4	0
24				1	3	— 2
25				5	7	— 2
26				5	37	—32
27				37	35	+ 2
28				8	9	— 1
29				8	7	+ 1
30				12	5	+ 7
			+49			—19

$\bar{x} = \frac{49}{20} = 2\ 45$

$S^2 = 14\ 16$

$S = 3\ 76$

$S\bar{x} = 841$

$t = \frac{2\ 45\ 0}{841} = 2\ 91$

$\bar{x} = \frac{19}{30} = 63$

$S^2 = 51\ 063$

$S = 7\ 15$

$S\bar{x} = 1\ 32$

$t = \frac{63\ 0}{1\ 32} = 48$

*Difference P-S = Privine — Saline
A-M O = Nose drop A — Mineral Oil

†Student s "t ' test (Statistical Methods G W Snedecor, 1946 p 44) where "t = mean of differences between two sets of observations — expected difference) — (standard deviation ÷ $\sqrt{\text{number animals}}$) was employed to test the significance of the difference between the number of revolutions produced by the nose drops and the control material A "t' value greater than 2 85 means that such a difference should occur not more than once in 100 times by chance when 20 animals are used and hence is highly significant When 30 animals are used, a ' t" value less than 2 04 means that the observed difference might arise by chance and is therefore not significant

TABLE 3 THE TOTAL ACTIVITY OF RATS GIVEN NOSE DROP PREPARATIONS AND CONTROL SOLUTIONS INTRAPERITONEALLY (CROSSOVER TESTS)

Exper No	No of Rats Used		Total Revolutions of Work Adder	Ratio of Revolutions Exper /Control	"t" Value and Significance	
1	10	Privine (0.1%)	1867*	18.67	3.71	H S
	10	Saline	67			
2	30	Nose drop A (0.1% ephed)	457	1.05	1.08	N S
	30	Mineral Oil	437			
3	30	Nose drop C (0.5% ephed SO_4)	1000	2.30	0.59	N S
	30	Saline	435			

*Three rats died on this dose of Privine, so that the number of revolutions recorded errs on the low side felt that the same approximate order of activity might hold regardless of quantitative differences

It will be noted from Table 3 that the two nose drop preparations tested containing ephedrine caused central stimulation, and of these the aqueous one proved much more stimulating than the oily one, as would be expected Privine, however, was more centrally stimulating than even the aqueous ephedrine nose drop

DISCUSSION

The results of these tests indicate That Privine, given intranasally or intraperitoneally, is more centrally stimulating than larger doses of ephedrine, that certain nose drops—*e g*, Privine—if given repeatedly by the nasal route, will cause central stimulation, that ephedrine in aqueous or oily phase, intranasally, does not cause stimulation in the doses examined These three points will be discussed, in this order, below

1 Warren and Werner (1945) found that when the four above tested pressor amines were studied by subcutaneous injection in the rat, in doses which were fractional parts of the LD50, their order of activity was as follows ephedrine> Privine>Tuamine>Neo-Synephrine They used doses that were 5, 10 and 20 per cent of the LD50 values At the 10 per cent level this would mean that their animals received the

TABLE 4 A COMPARISON OF THE APPROXIMATE AMOUNTS OF PRESSOR SUBSTANCES GIVEN INTRANASALLY (OR INTRAPERITONEALLY) and SUBCUTANEOUSLY (DATA FOR THE LATTER TAKEN FROM PAPER BY WARRREN AND WENER)

Pressor Agent	LD50* Mg/Kg	10% of LD50 Mg/Kg	Amts Given in Present Test Mg/Kg†
Ephedrine	800	80	14‡
Privine	420	42	2 8
Tuamine	130	13	56
Neo Synephrine	28	2 8	28

*All compounds were tested as the hydrochloride salts except Tuamine, which was tested as the sulfate

†Calculations based on 0 7 cc /250 gm rat i e 2 8 cc of nose drop preparation per Kg

‡Using aqueous nose drop containing 0 5% ephedrine sulfate

amounts listed in Table 4 For purposes of comparison, the quantities given intranasally or intraperitoneally to our rats are recorded in the last column of the same table

It is evident from the results given in Table 1 and 3 that nose drops containing Privine proved to be more centrally stimulating than those containing ephedrine, even though the dose of ephedrine was greater than Privine This relationship was found regardless of whether the nose drops were given intranasally or intraperitoneally The aqueous nose drops contained 0 5 per cent ephedrine sulfate, whereas Privine nose drops contained 0 1 per cent Privine hydrochloride In milligrams per kilogram this is equivalent to a dose of 14 mg/kg for ephedrine sulfate and 2 8 mg/kg for Privine hydrochloride Warren and Werner (1945) found that ephedrine was more stimulating than Privine when injected subcutaneously This difference in order of activity may be due to the different routes of administration used and/or the fact that our preparations were commercial products with other substances present, and that these substances modified the absorption of the active pressor agents

The dose of Privine used in the present study, when considered in relation to the LD50 values, was proportionately less than that used for the other pressor amines and, on a weight basis, therefore, Privine was the most active of all agents tested

2 It was found that if repeated doses of 0 1 per cent Privine were given intranasally to rats over a period of time central stimulation would result The amounts administered were large — 0 7 cc for a 250 gm rat corresponds on the same weight basis to 196 cc for a 70 kg man Actually, the volumes required to cause central stimulation would be somewhat less than this, as administration of nose drops to the rat is attended with some loss The method was used, however, as it is the route by which the drugs would be taken therapeutically and moreover, for comparative studies, the dosage error would be approximately the same for all test groups

3 An important finding was that none of the nose drops tested containing ephedrine (oily nose drops A and B and aqueous nose drop C) proved to be centrally stimulating when given intranasally in spite of the relatively large doses used Intraperitoneally, both the oily preparation (nose drop A, 0 3 per cent ephedrine) and the aqueous nose drop (nose drop C, 0 5 per cent ephedrine sulfate) were centrally stimulating, the latter being more active than the former This difference was probably due to a difference in absorption from the two solutions as the dose of ephedrine base was the same in each

Finally, it is believed important to emphasize that any conclusions that may be drawn from this study apply only to commercial nose drop preparations as tested under the conditions described and no generalizations with regard to the centrally stimulating action of the pure pressor amine is implied

SUMMARY

1 Five different commercial nose drop products and one other prepared in the laboratory, each of which contained a pressor amine, were tested for their central stimulant action in the rat following intranasál administration Privine was the only one found to be active

2 Privine, oily nose drop A (0 3 per cent ephedrine), and aqueous nose drop C (0 5 per cent ephedrine sulfate) were also tested for their stimulant action following intraperitoneal injection All were found to be stimulating, with Privine the most effective Of the two preparations containing ephedrine, the aqueous drops were more stimulating than the oily ones

3 The results are discussed in relation to those previously reported

REFERENCES

1 Warren M R, and Werner, H W Central Stimulant Action of Some Vasopressor Amines *Jour Pharmacol and Exper Therap*, 85 119 121, 1945

2 Schulte, J W, Reif, E C Bacher J A, Jr Lawrence W S and Tainter M L Further Study of Central Stimulation from Sympathomimetic Amines *Jour Pharmacol and Exper Therap* 71 62 71, 1941

DR THOMAS WILLIS (1621-1675)

A Great Seventeenth Century English Anatomist and Clinician Who Anticipated Many Modern Discoveries

WALTER A WELLS, M D ,
Washington, D C

Dr Thomas Willis was a contemporary of Dr Thomas Sydenham and, in his day, a man of far greater renown With the passing of years, however, a reversal has taken place, and in medical history Sydenham, "the great English Hippocrates," as he is called, has become such a dominating figure of that period that were it not for certain eponyms which have survived, the name and fame of Willis would be almost completely obscured

We do not hear much of the Willis nerve, as the accessory nerve has been called, nor of Willis disease, another name for diabetes, but there are two Willis eponyms that are household words in our medical literature

No one with the least pretense of anatomical knowledge can be unfamiliar with "The Circle of Willis," and surely no otologist could be unfamiliar with the meaning of the expression "Paracusis Willisii "

All deaf persons who have noticed the peculiar phenomenon of hearing better in the midst of noise must share with medical men some curiosity as to the person for whom this symptom is named

1 The Circle of Willis This is the name universally bestowed on the network of anastomosing arteries presenting an approximately hexagonal figure at the base of the brain

It was first described by Willis in his "Cerebri Anatome"

Editor's Note This ms received in Laryngoscope Office and accepted for publication Jan. 19 1949

tested containing ephedrine (oily nose drops A and B and aqueuous nose drop C) proved to be centrally stimulating when given intranasally in spite of the relatively large doses used Intraperitoneally, both the oily preparation (nose drop A, 0 3 per cent ephedrine) and the aqueous nose drop (nose drop C, 0 5 per cent ephedrine sulfate) were centrally stimulating, the latter being more active than the former This difference was probably due to a difference in absorption from the two solutions as the dose of ephedrine base was the same in each

Finally, it is believed important to emphasize that any conclusions that may be drawn from this study apply only to commercial nose drop preparations as tested under the conditions described and no generalizations with regard to the centrally stimulating action of the pure pressor amine is implied

SUMMARY

1 Five different commercial nose drop products and one other prepared in the laboratory, each of which contained a pressor amine, were tested for their central stimulant action in the rat following intranasal administration Privine was the only one found to be active

2 Privine, oily nose drop A (0 3 per cent ephedrine), and aqueous nose drop C (0 5 per cent ephedrine sulfate) were also tested for their stimulant action following intraperitoneal injection All were found to be stimulating, with Privine the most effective Of the two preparations containing ephedrine, the aqueous drops were more stimulating than the oily ones

3 The results are discussed in relation to those previously reported

REFERENCES

1 Warren M R, and Werner, H W Central Stimulant Action of Some Vasopressor Amines *Jour Pharmacol and Exper Therap*, 85 119 121 1945

2 Schulte, J W, Reif, E C Bacher J A Jr Lawrence, W S and Tainter, M L Further Study of Central Stimulation from Sympathomimetic Amines *Jour Pharmacol and Exper Therap* 71 62 74 1941

DR THOMAS WILLIS (1621-1675)

A Great Seventeenth Century English Anatomist and Clinician Who Anticipated Many Modern Discoveries

WALTER A WELLS, M D ,
Washington, D C

Dr Thomas Willis was a contemporary of Dr Thomas Sydenham and, in his day, a man of far greater renown With the passing of years, however, a reversal has taken place, and in medical history Sydenham, "the great English Hippocrates," as he is called, has become such a dominating figure of that period that were it not for certain eponyms which have survived, the name and fame of Willis would be almost completely obscured

We do not hear much of the Willis nerve, as the accessory nerve has been called, nor of Willis disease, another name for diabetes, but there are two Willis eponyms that are household words in our medical literature

No one with the least pretense of anatomical knowledge can be unfamiliar with "The Circle of Willis," and surely no otologist could be unfamiliar with the meaning of the expression "Paracusis Willisii "

All deaf persons who have noticed the peculiar phenomenon of hearing better in the midst of noise must share with medical men some curiosity as to the person for whom this symptom is named

1 *The Circle of Willis* This is the name universally bestowed on the network of anastomosing arteries presenting an approximately hexagonal figure at the base of the brain

It was first described by Willis in his "Cerebri Anatome"

Editor's Note This ms received in Laryngoscope Office and accepted for publication, Jan 19 1949

first biographer, the quaint chronicler of the era, Anthony a Wood, who insinuated that Willis' reputation as an anatomist was largely due to his exceptionally skilled assistants, and on another occasion when referring to his tremendous income from practice he intimated that this was Willis' chief aim in life Sir Michael Foster, in his history of physiology, said of Willis, "A love of truth in him was less potent than love of fame, his mind was of the rhetorical sort, he loved words and looked upon an illustration as an argument and when he described an analogy, thought he had found a proof"

In a recent History of Medicine (Mettler, Phil, 1947) an unmistakable bias is evident toward this English physician

The author seems never to be able to mention his name without adding a slighting remark, indeed, the apparent animosity is carried so far as to include persons who favor him Sir Charles Bell, the distinguished discoverer of reflex action of nerves, gives credit to Willis for the discovery of the accessory nerve For doing this, Bell is labeled as one "whose knowledge of anatomical literature was exceeded only by his ambition"

On page 66, we read, "Thomas Willis had one of the most fashionable and lucrative practices in London He was something of a dandy, and while neither original nor erudite, he was fortunate to secure the help of two men, each about a decade his junior, Richard Lower and Christopher Wren, in the preparation of the work upon which his reputation as an anatomist is based"

Again (page 720), "Late in the seventeenth century Thomas Willis wrote on pertussis (1675) which by that time was thoroughly familiar In his "Pathologiae cerebri et nervosi generis specimen" (Oxford, 1667) he also discussed infantile convulsions He still dealt with the epilepsy convulsion complex as it had been defined by the ancients, and neither this account nor that of pertussis discloses marked clinical perspicacity Both descriptions were extensively exploited as an opportunity to give an exposition of the peculiar physiological theories to which this author subscribed"

In calling him a dandy the prejudice toward Willis is obviously betrayed it is perhaps based on the fact that he had a fashionable practice

In the account given by Wood, who is often caustic in his descriptions and never withholds a critical comment, there is nothing to support this view, but rather the contrary Wood wrote,

"Though Dr Willis was a plain man of no carriage, little discourse, complaisance or society, yet for his deep insight, happy researches in natural and experimental philosophy, anatomy and chemistry, and for his wonderful success and repute in practice, the natural smoothness, pure elegance, delightful, unaffected neatness of Latin style none scarce have equaled, much less outdone him, how great so ever

"When at any time he is mentioned by authors, as very often is done in words expressing their high esteem for his great worth and excellency, he is placed still as first in rank among physicians

And further also he hath laid a lasting foundation of a body of physics chiefly in hypothesis of his own framing"

We shall later present testimony that tends to controvert some of the unfavorable opinions expressed by the detractors of Willis, and to prove that he was indeed a man of remarkable originality, profound learning, keen perception and prodigious industry and with all a man of extraordinary noble character

Thomas Willis was born at Great Bedwyn in Wiltshire, Jan 27, 1621

He was sent to an excellent private school conducted by Mr Sylvester, of Oxford Wood in his "Athenae Oxienis" tells a little story of his early school days which in view of slurs by certain authors upon his character, as well as his ability, is worth quoting "It might be added, as the boy is said to be father of the son, that Willis on his way to school would give his victuals away to the poor, who have a wonderful faculty for discovering generous people and never spare them His father, fearing that the boy would starve himself, compelled him to eat all his food at home" After a term in Mr Sylvester's school, he enrolled as a student in the College of Christ Church He received his B A degree in 1641, and his M A in 1642 About this time the King visited Oxford and in his train was the great Harvey Was this the inspiration that prompted him to become a doctor of medicine?

Harvey did not allow the war or his duties as Royal physician to interfere with his medical investigations during his three years' residence at Oxford We are told by Wood that he kept a hen in one of the University rooms in order to use the eggs at different stages of incubation for the study of embryology

Willis may have been influenced also by other great medical investigators who were at Oxford at that time or had recently been there — namely, Francis Glisson (Glisson capsule), Thomas Wharton (Wharton's duct), Nathaniel Highmore (the antrum of Highmore)

Sydenham had begun his studies at Oxford, but being a Roundhead, he was now playing the part of a soldier in the Parliamentary forces bent upon the capture of the King's stronghold

Willis joined the garrison in the royal defense, and it is said that during these days he spent all his available time in the pursuit of medical studies

Parliamentary forces captured the city and took control of the University, but did Willis flee to London or to the country as did many of the King's partisans? Not at all, and in his staying we witness two things worthy of admiration one, the conscientious resolution which guided Willis, the other, the tolerant spirit displayed by Cromwell

Willis took a house opposite Merton College, where he gave refuge and sustenance to members of the clergy who were hated and persecuted by many of the followers of Cromwell ("a dangerous thing to do," remarks Wood), and here he set up an oratory, where the Church of England service was daily conducted for the faithful who cared to resort there

He was never molested, but was allowed to continue his studies, and actually received his degree, Bachelor of Medicine, under Parliamentary auspices (The surrender to Fairfax took place on June 24, 1646 Willis was granted his degree Dec 18 of that year)

Willis remained in Oxford throughout the whole period of the Commonwealth, became very beloved as a physician and was sought far and wide by persons of all degree and all faiths

He was noted for his piety and generosity, he gave his services without fee to the poor, and his Sunday earnings were given to charity

Although very busy in the practice of medicine, Willis some way found time to devote to research and writing

He was tremendously interested in all discussions concerning the cause and nature of disease and the means of cure, and he turned to the fundamental science for enlightenment

As he says in the introduction of his treatise on the anatomy of the brain and nervous system, he was determined "not to pin my faith on the opinion of others nor yet on the opinion and guesses of my own mind, but for the future to believe only mature and accurate demonstration in order that a firm and stable basis may be laid"

He made careful studies especially in anatomy, physiology and chemistry, in anatomy by personal dissections, in physiology and chemistry by carefully conducted experiments In his anatomical investigation he was fortunate in having the assistance of several young men of unusual talent animated like himself by the spirit of scientific inquiry

Some authors have ascribed the chief merit of Willis' treatise on the anatomy of the brain and nervous system to two of these young men Richard Lower, who later did some notable anatomical work on his own account, and Christopher

Wren, who became the famous Sir Christopher, architect of St Paul and other celebrated structures

Wren began as a medical student and being a good draftsman helped his chief by making anatomical drawings

He is said to have devised the first instrument for making blood transfusions and he and Lower made the first recorded experiments in transfusing blood from one animal to another

Willis in the introduction of his treatise gave full credit to these young men for their valuable assistance, and it is our guess that if the young men themselves, who were each 10 years younger than Willis, had said anything at all, they would have expressed their appreciation of the master genius in inspiring and directing their energies

Admitting for argument's sake that in the case of his treatise on anatomy, chief credit belongs to his two talented assistants, those who belittle the genius of Willis must still explain the numerous other works of this author which exhibit equal originality and were acclaimed as masterpieces in the medical world of his day

He wrote treatises on the following subjects *1* Fermentation *2* Fevers *3* The Urine *4* The Ascension of the Blood *5* Muscular Motion *6* Pathology of the Nervous System *7* Convulsive Diseases (Rational Therapeutics) *8* The Scurvy *9* The Soul of Brutes

All of these treatises were written in faultless Latin, and in his day were all immensely popular in medical circles at home and abroad

Besides Wren and Lower, several other men at Oxford were deeply engaged in scientific studies and unmindful of the turmoil and strife going on all around them Frances Bacon by the publication of his principles for the interpretation of nature had given great impetus to scientific investigation

Progress could not be expected, as he showed by *a priori* argument and scholastic disputations with blind adherence to authority

It was necessary to resort to accurate observation and experience and to apply the inductive method of reasoning to the information so attained

Enthusiasm for research was aroused everywhere, but nowhere more than at Oxford

In his "New Atlantis" he had suggested the formation of societies of learned men to concentrate on the discovery of the secrets of nature, and at Oxford a group of men including Thomas Willis was organized for this purpose under the name of the Philosophical Society A similar group had begun meetings in London

Shortly after the Restoration these two were amalgamated, and granted a charter by Charles II, and thus was born the famous Royal Society

Bacon was particularly interested in the science of medicine He wrote

"Our physicians rely too much on mere haphazard, uncoordinated individual experience, let them experiment more widely, let them illuminate human with comparative anatomy, let them dissect and if necessary vivisect, and above all let them construct an easily accessible and intelligible record of experiments and results"

The Oxford men of medicine must have felt particularly close to Bacon, for instance, Harvey, who had been his personal physician Quite remarkable is the fact that several of this group, who were closely associated with Willis in the studying of medical problems, rose in later life to the highest rank in other branches of science we have already spoken of Sir Christopher Wren, before were John Locke, who later wrote "The Essay on Human Understanding," and came to rank as one of the world's great philosphers, and Sir William Pettys, who forsook medicine for the Science of Political Economy, often spoken of as the father of that science

When Pettys was Professor of Anatomy at Oxford, and in that capacity had assigned to him for anatomical studies the bodies of condemned criminals, he gained great notoriety by his resuscitation of a certain Anne Green, who was thought to be "hanged by the neck until she was dead" By his skill she was restored to life, and, so it was said, became a respectable citizen of the community

Willis was distinguished no less as a philosopher than as a physician In 1660, he received the appointment of Sedleian Professor of Philosophy at the University, replacing the incumbent, who was, as Wood bluntly puts it, "ejected" from that office

After 30 years at Oxford, devoted to study, experimenting, writing, lecturing and the practice of medicine, Willis, on the special urging of the Archbishop of London, moved to the metropolis His fame had preceded him, so that instantly he duplicated his success at the University City and became London's most distinguished physician, much sought after in fashionable and court circles

It was natural to expect that he would now become Sir Thomas Willis and no doubt he could have done so except that he put conscience ahead of ambition

When he was called in consultation in the case of the ailing son of the Duke of York, afterward James II, he diagnosed the case as "*mala stamina vitae*" The King was shocked and took such offense that Willis from then on was *persona non grata* at court

That he was absolutely right, however, in his diagnosis, there can be little doubt in the mind of any well informed physician, especially in view of subsequent family history

James by his marriage with Anne Hyde had eight children, of which this sickly son was one All the rest, except two daughters, Mary and Anne, died in early life All the children, wrote a chronicler of the era, "were born with ulcers, or they broke out on them soon after, all were unhealthy and died young His eldest daughter suffered with violent pains in the eyes, and Queen Anne, with gout due to dregs of the original taint"

William and Mary had no offspring Poor Queen Anne had child after child, some say as many as 19, which did not live

Willis took a house in historic St Martins Lane not far from the church of St Martins As at Oxford, so in London, he was a faithful and devout churchman, and attended services twice daily He rose early in the morning, in the winter at seven and summer at six, so that he could attend service before beginning his daily rounds

Out of his funds he provided a special allowance which made it possible for services to be held at other than regular hours for those who, on account of their work, could not otherwise attend

There should be no question but that Willis was a man of admirable character, kind, charitable, conscientious, steadfast, and one who would never sacrifice principle for preferment

What should be said as to his ability? What place should be properly assigned him in medical history? If we accept the estimate of some of his detractors, he deserves no place at all, but there are some, of good authority, who think otherwise Garrison ranks him among the great English clinicians, in the same class as Sydenham and Heberden, and praises him highly for his talent for close careful clinical observation — which led him to be the "first to establish the basic principle of diabetes melletus and other diseases" He gives him credit for being the first to describe epidemic typhoid fever, the first to describe and name puerperal fever His work on nervous diseases, Garrison says, is justly esteeemed for its many striking clinical pictures, of which his descriptions of paralytic dementia is perhaps the most important He refers to the fact that he was the first to describe the disease now designated as myasthenia gravis

Referring to his contribution to anatomy, his anatomy of the brain and nerves is said to be the most complete and accurate description that had been made up to his time, and it is notable that his classification of the cranial nerves continued to be standard for the next 200 years

Giving him credit for the discovery of the accessory nerve, Garrison evidently does not agree with Mettler, who, as we noted, would deprive him of that honor At any rate, it must be admitted that Willis added to the existing knowledge of the cranial nerve in his description of the pneumogastric or vagus nerve Previous to his time, the various fibres attached to sympathetic were considered an integral part of the nerve

W S Miller (Soc Med Hist, Chicago, 1923-1925, p 227) has stressed his original work in the anatomy of lungs

Malpighi by his microscopical studies had correctly indicated the structure of the lung

By further experimental work Willis proved by direct injection of mercury into the blood vessels that there was not a general intercommunication between air spaces, as formerly believed, but that there were distinct areas marked off by connective tissues, each of which was supplied by a bronchial tube — a good description of what today are called secondary lobules of the lung

---

If Dr Willis had made no other advance in medical science than that of pointing out the significance of sugar in the urine, for that alone he deserves recognition as a great benefactor to the human race

Before his time there had been some sort of association of excessive urination with wasting disease, but he was the first to indicate that this was particularly true of those cases where the was a sugary content

He hit upon this idea by a simple expedient which no one before had thought of or had the courage to try, namely, tasting the urine

It was the beginning of our understanding of the most important of all our metabolic disorders — one which is said to afflict no less than 2,000,000 people in the United States alone

The priority of Willis in this field is recognized by Prof Ralph H Major in his excellent recent work entitled, "Classic Description of Disease"

His original description is reproduced under the title, "On the too much evacuation of the urine and its remedy, and especially of the disease or pissing evil, whose theory and method of curing is inquired into"

When comparing Willis with his great contemporary, Sydenham, one ought to bear in mind that while Sydenham was a clinician and little else besides, Willis, with his knowledge of practical medicine, was at the same time an anatomist, chemist, physiologist and philosopher, he was a profound student of the fundamentals of his art, and diligently engaged in scientific research and experimentation

Sydenham cared little for theory and speculation but depended almost entirely upon his own individual experience He employed the direct approach in his study of disease processes, and being an exceptionally keen observer and gifted with a natural instinct for recognizing resemblances and discarding nonessentials in the manifestations of disease, he gave to the profession the most lucid, concise and orderly description of disease processes it had ever possessed

Willis was overfond of theory and speculation, and his tendency to indulge in them without restraint is the chief cause of his downfall, or rather we should say of his loss of favor in medical history

His great fault was that in his description of disease, he aimed to paint a too perfect picture He thought it was up to him, in every case, to give the whole answer

In making these lengthy explanations, it was necessary to make them in terms of the prevailing theories of the day — so that we have much talk of humors, spirits, and fermentation, etc, which to modern readers is only a lot of meaningless jargon

The effect is to weary the reader and to prejudice him against the author

Sydenham, as we know, believed in humors, but he seldom mentions them Avoiding such matter, fortunately for his reputation, he spoke a language which everyone can underthan "The Adventures of Gil Blas," an indirect way of saying the genito-urinary approach

His disdain for preconceived opinions and authority is illustrated by the answer he once gave a medical student who asked him what book he should read in preparation for the study of medicine His answer was that he knew none better than "The Adventures of Gil Blas," a rough way of saying that there is no other way to learn to treat disease than by close observation at the bedside

Willis reveled in elaborate speculation, and he wrote so much that seems worthless that the average reader is inclined to believe that nothing he produced was worthwhile, however, if one has the patience to dig beneath the surface he will find some nuggets of pure gold The amazing thing is that Willis darkly indicated much more than he openly produced His work is actually rich in foreshadowings of future progress

Michael Foster, one of his severest critics, admitted that he had dimly outlined the theory of reflex nerve action — a theory that was not brought to light until some hundred years later

This is only one of his many prophetic visions Careful search of his work revealed that he anticipated the modern doctrine of the vasomotor nerve action, internal secretion, metabolism, oxygenation of the blood in respiration and cerebral localization, and the workings of the subconscious mind

Is not the vasomotion action remarkably well stated in the following?

"The small lines and cords of nerves, by acting on the muscular coat of the vessels to which they are distributed, do variously straighten, compress or it may be sometimes quite shut those blood carrying vessels"

Again, have we not an unmistakable forecast of the doctrine of internal secretion in his description of the blood supply of the genitourinary approach

"The blood pours forth something through the spermatic arteries, so that it receives as recompense a certain ferment from those parts — to-wit, certain particles imbued with a seminal tincture to the bloody mass which make it vigorous and inspire in it a new and lively virtue '

Still again, does he not give a certain intimation of the metabolic processes when in describing the fermentation, he speaks of it as a "process producing body charge by converting one element into another?"

It was not until 1775 that the great French chemist, Lavoisier, proved by his experiments the true nature of respiration, the oxygenation which took place when the air was inspired into the lungs, he showed was, in fact a combustion, identical with that which takes place outside of the body

More than 100 years earlier Willis anticipated this discovery

In his discussion of the physiology of the circulation, the heating of the blood likened to a fire or vital flame, and then he uses these explicit words "and because blood first rushes into the lungs having there got an accession of air begins to burn"

Willis was the father of cerebral localization As usual he went much further than his information justified and so made some egregious mistakes, when in a categorical manner he placed, for example, animal instincts in the corpora quadrigemera, certain vital functions in the cerebellum, etc., but it was a beginning and a suggestion for future investigations which have proven of great importance in cranial surgery

Finally, we may consider Willis as having laid the foundation of the doctrine of the subconscious mind, a doctrine developed by Freud and widely exploited in recent years both in medical and lay circles

Willis in the latter years of his life devoted most of his energies to philosophical subjects rather than to medicine pure and simple In 1670, he wrote a treatise on hyseria, treating the subject from a psychological point of view, and in 1672 he brought out his treatise on the soul of brutes *(De aninma brutarum)*, an abtruse philosophical study which was much discussed at the time He considered it his most important work and Osler has said that every physician desiring to be well-informed should read it

While in lower animals there is but one soul, a corporeal one *(anima sensitiva)*, in men there are two, the corporeal and incorporeal

The lower or bodily soul is divided into two parts, one in resident in the blood, and of the nature of flame, the other one in the nerves and of the nature of light

The corporeal soul is the soul of appetite, passion, and of mechanical and rhythmical action It can influence the rational soul and in turn be influenced by it

This duality of the mind or its division into a reasoning and an automatic mind, he considered as illustrated by the case of the idiotic youth (mentioned in treatise on hysteria), who at each hour, exactly on the hour, had the habit of crying out clock-like throughout the 24 hours of the day, at exactly the right time

While the work of Willis in psychology has received but scant attention from English or American writers, it has not been the same elsewhere

In an article which appeared in the *Annales medico-psychologique* in 1928 (XVIII, p 119) under the title *e*, "Un maitre de la psychiatrie au XVII^{ms} siecle, Thomas Willis" (17th century master of neuropsychiatry, Thomas Willis) the two authors, Jean Vichon and Jacques Vie, hail him as a great pioneer in this branch By his powerful imagination, combined with acute reasoning, he anticipated in a remarkable way, they say, some of the modern thoughts and practices in this branch of medicine

Willis is generally regarded as an "iatro-chemist," that is, one of those who believed that all the processes of nature were to be explained in chemical terms and that the care of diseases could accordingly be effected by chemical remedies

He was so regarded because he followed Francois Sylvius, the head of that school, in adopting the idea of fermentation as an important agent in vital processes

Willis, however, was not a strict adherent of this school, he adopted also some of the ideas advocated by the iatro-physcients, and he had some particular ideas of his own

Willis has been criticized as a practitioner of polypharmacy

Osler wrote "When I look through the list of drugs that were given and the prescriptions that were then followed, I feel that the public has to thank the profession for having gotten rid of so many nauseous drugs

"In some of Willis' prescriptions there were 10 to 15 ingredients, each worse than the other, besides vomits, purgings, sweatings, diuretics, cordials and opiates"

He was in this respect a follower of his times, but at that not so bad as the worst of them

It was a frequent practice for physicians to administer prescriptions having 20 or 30 ingredients — and the pharmacopea of the period carried the famous "therica" which contained 64, besides it included as proper to be used preparation made of bile, urine, claws, teeth, hoofs, coxcombs, furs, feathers, isinglass, spiders' webs and many other offensive and impossible things — which I feel sure Willis never made use of In fact, he sought to reform many of the irrational practices of his contemporaries in the use of remedies

"They promise themselves," he wrote, "presently to cure all diseases and give them boldly in every case to the great injury and not infrequently to the destruction of the patient, so securely and rashly are these executioners accustomed to trifle with human life while they are led to the preparing and administering of these medicines in which always lurks some venomous sting without any council or direction of method, but by mere chance and with a blend impetuosity"

That Willis was guided by scientific experiment rather than pure empiricism is evident by the fact that he investigated the effect of anatomical urine by injecting it into the veins of dogs The vomiting that ensued he attributed to the explosion of animal spirits

The effect of drugs in his opinion was chiefly due to their action upon spirits in the stomach

His good judgment is evinced by the fact that he expressed his belief in the effectiveness of the comparatively new remedy, Peruvian bark (cinchona) in the cure of quartan fever

In accordance with prevailing practice, he advocated depletives including venesection in cases of hemoptysis—but he deserves the highest praise for being the first to recommend a method of treating tuberculosis, the great importance of which was not recognized until these modern times

The belief that the consumptive must be protected from the outside air rather than exposed to it continued strong in English medical as well as lay circles well into the nineteenth century

Poor John Keats (1795-1821), a consumptive, was not only bled by his attending physicians after every hemorrhage but he was shut up in his room, with closed doors and windows and strictly admonished not to venture a step forth in the night air or during the least inclement weather

Willis recognized that fresh air was of distinct value in his consumptive patients

Referring to a particular case, he wrote, "The chiefest help accrued to him from the open air—for from thence he first began to recover his appetite, his digestion and sleep till at length he recovered his health"

Willis died from an attack of pneumonia, in all probability of influenzal origin—as an epidemic of apparent influenzal character was present at that time

The high estimation in which he was held may be judged from the fact that he was accorded the honor of burial at Westminster, and this despite the fact that he was not loved by the King

In 1731, his grandson, Brown Willis, who inherited his fortune, wishing to do him further honor, had erected a church in Buckinshire, where during his life a festival was held annually to commemorate the name of Thomas Willis

It was called St Martins, after the name of the church in which he worshipped in London

Brown Willis was a distinguished antiquarian and an authority on old English cathedrals During his life, he arranged to have a festival held yearly in the little town of Fenny Stratford, where he lived and where the church stood, and he provided in his will for the continuation of the ceremony after his death

In November, 1916, Sir William Osler was the orator of the occasion

A memorial of this nature was as appropriate as any that could be imagined to commemorate the life and works of a man who was such a devout churchman and distinguished no less for his goodness of heart than for his scholarly attainments

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

The annual meetings of the Triological Society and the Broncho-Esophagological Association will be held concurrently at the Drake in Chicago on April 18, 19 and 20, 1949 A joint meeting of these two societies will take place Tuesday morning, April 19 On the other days the Triological Society will meet in the mornings and the Bronchoscopic Society in the afternoons

We also call your attention to these dates and places

American Board of Otolaryngology—May 11-14, 1949, New York City

American Laryngological Association — May 16-17, 1949, New York City

American Otological Society—May 18-19, 1949, New York City

In order to facilitate the coordination of national meetings, the Bronchoscopic, the Otological, the Laryngological and the Triological Societies are considering a five-year plan of dates and places By adoption of such a scheme we hope to reduce the traveling mileage and the amount of time away from our offices For additional information, write to Dr C Stewart Nash, Secretary, 708 Medical Arts Building, Rochester 7, N Y

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETS AT ST LOUIS, SEPT 28, 29, 30, 1949

The Fourteenth Annual Meeting of the Mississippi Valley Medical Society will be held at the Jefferson Hotel, St Louis, Mo, Sept 28, 29, 30, 1949, under the presidency of Dr Alphonse McMahon, of St Louis University At the recent current meetings of the Society and board of directors, the following officers were elected Dr Nathaniel G Alcock, Iowa City, Iowa, President-elect, Dr Wendell G Scott, St Louis, Mo, First Vice-President, Dr Charles F Harmon, Springfield, Ill, Second Vice-President, Dr John I Marker, Davenport, Iowa, Third Vice-President, Dr Harold Swanberg, Quincy, Ill, Secretary-Treasurer, Dr Ralph McReynolds, Quincy, Ill, Accounting Officer

INTERNATIONAL CONGRESS OF OTOLARYNGOLOGY, LONDON, 1949

The British Association of Otolaryngologists is organizing the Fourth International Congress of Otolaryngology, to be held in London from July 17 to July 23, 1949 There will be further meetings, for those who wish to go, at Oxford, Cambridge and Edinburgh on July 25 and 26 It is hoped that a full academic program will be arranged, and also various social functions

The secretaries of the National Otolaryngological Societies have been circularized and asked to send a list of their members for individual notification Should any association not receive this letter, they should communicate with the General Secretary, F C W Capps, F R C S, 45, Lincoln's Inn Fields, London, W C 2

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co, 4602 Nicollet Ave, Minneapolis 9, Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories, 815 S Hill St., Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2

Manufacturer Otarion Hearing Aids, 159 N Dearborn St, Chicago Ill

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS

Manufacturer Paraphone Hearing Aid, Inc, 2056 E 4th St., Cleveland, Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale, Chicago 14, Ill

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone

Manufacturer E A Myers & Sons, 306 Beverly Rd Mt. Lebanon Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp, 6001 W Dickens Ave, Chicago, Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp, 101 Tremont St, Boston 8, Mass

Solopak Hearing Aids

Manufacturer Allen Howe Electronics Corp, 150 Main St, Peabody, Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford, N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc 2454 S Michigan Ave, Chicago Ill.

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex Inc Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc 1627 Pacific Ave Dallas 1, Tex.

Trimm Vacuum Tube No 300

Manufacturer Trimm Inc, 400 W Lake St., Libertyville, Ill

Unex Model "A"

Manufacturer Nichols & Clark, Hathorne Mass

Vactuphone Model 3

Manufacturer Allen Howe Electronics Corp Salem Mass

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc. 120 Broadway, New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave Chicago Ill

All of the accepted hearing devices employ vacuum tubes

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co, 4602 Nicollet Ave, Minneapolis 9 Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories, 815 S Hill St., Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2

Manufacturer Otarion Hearing Aids, 159 N Dearborn St, Chicago, Ill.

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS

Manufacturer Paraphone Hearing Aid, Inc, 2056 E 4th St, Cleveland, Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale, Chicago 14, Ill

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone

Manufacturer E A Myers & Sons 306 Beverly Rd, Mt. Lebanon Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp, 6001 W Dickens Ave, Chicago, Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp, 101 Tremont St Boston 8, Mass

Solopak Hearing Aids

Manufacturer Allen Howe Electronics Corp, 150 Main St, Peabody, Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford, N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc, 2454 S Michigan Ave Chicago, Ill.

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex, Inc, Minneapolis 1 Minn

Tonemaster Model Royal

Manufacturer Tonemasters, Inc 1627 Pacific Ave Dallas 1, Tex.

Trimm Vacuum Tube No 300

Manufacturer Trimm Inc 400 W Lake St., Libertyville Ill

Unex Model "A."

Manufacturer Nichols & Clark, Hathorne, Mass

Vactuphone Model 3

Manufacturer Allen-Howe Electronics Corp, Salem Mass

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc, 120 Broadway, New York 5, N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave Chicago Ill

All of the accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Marvin F Jones, 121 E 60th St, New York 22, N Y
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3 N Y
Meeting New York, N Y, May 18 19, 1949

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Frederick T Hill, Professional Bldg, Waterville, Me
Secretary Louis H Clerf, 1530 Locust St, Philadelphia 2, Pa.
Meeting New York, N Y, May 16 17, 1949

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr John J Shea, 1018 Madison Ave, Memphis, Tenn
Secretary Dr C Stewart Nash, 708 Medical Arts Building, Rochester, N Y

Annual Meeting Chicago, Ill, Hotel Drake, April 18 20, 1949

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St, Charlottesville Va.

Secretary Dr James M Robb, 641 David Whitney Bldg, Detroit, Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens 35 E 70th St, New York, N Y
President Elect Dr J Mackenzie Brown, 1136 W 6th St., Los Angeles, Calif

Executive Secretary Dr William L Benedict Mayo Clinic, Rochester, Minn

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley 384 Post St., San Francisco, Calif
Secretary Treasurer Dr Joseph Hampsey, 806 May Bldg, Pittsburgh 22, Pa

AMERICAN BOARD OF OTOLARYNGOLOGY

Ieeting New York, N Y, May 11 14, 1949

PAN AMERICAN ASSOCIATION OF OTO RHINO LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

'resident Prof Justo Alonso

ecretary Dr Chevalier L Jackson, 255 S 17th St., Philadelphia, Pa

econd Pan American Congress of Oto-Rhino Laryngology and Broncho-Esophagology Montevideo, January, 1950

AMERICAN BRONCHO ESOPHAGOLOGICAL ASSOCIATION

resident Dr Paul Holinger, 700 N Michigan Ave, Chicago 11, Ill

ecretary Dr Edwin N Broyles, 1100 N Charles St Baltimore 1, Md

Ieeting Chicago, Ill., April 18 20, 1949

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

'resident Dr Colby Hall

ecretary Treasurer Dr Warren A Wilson.

hairman of Section on Ophthalmology Dr John A Bullis

ecretary of Section on Ophthalmology Dr Rodman Irvine

hairman of Section on Otolaryngology Dr Leland G Hunnicutt

ecretary of Section on Otolaryngology Dr Alden H Miller

'lace Los Angeles County Medical Association Bldg 1925 Wilshire Blvd Los Angeles, Calif

ime 6 P M fourth Monday of each month from September to May, inclusive

MERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner, 115 E 61st Street, New York 21, N Y

Secretary Dr Norman N Smith 291 Whitney Avenue New Haven 11 Conn.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss 165 Eighth Ave North Nashville 3, Tenn

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg, Atlanta 3 Ga

Vice Chairman Dr V R Hurst 315 N Center St. Longview Tex

Secretary Dr Alston Callahan 908 S Twentieth St., Birmingham 5, Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St., Philadelphia, Pa.

Vice President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore, Pa.

Treasurer Dr Harry P Schenck, 1912 Spruce St., Philadelphia, Pa

Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Vicente Banet

Vice-Presidente Dr José Lastra

Secretario Dr René Smith

Vice-Secretario Dr Luis Rodríguez Baz

Tesorero Dr Antonio Rodrigues Diaz

Vice Tesorero Dr Tomás Armstrong

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier

First Secretary Dr Gabriel Porto

Second Secretary Dr Roberto Barbosa

Librarian Treasurer Dr Leoncio de Souza Queiroz

Editors for the Archives of the Society Dr Guedes de Melo Filho, Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino

Vice Presidente Dr Luis E Olsen

Secretario Dr Eugenio Romero Díaz

Tesorero Dr Juan Manuel Pradales

Vocales Dr Osvaldo Suárez, Dr Nondier Asís R Dr Jorge Bergallo Yofre

THE
LARYNGOSCOPE.

VOL LIX APRIL, 1949 No 4

MANAGEMENT OF CARCINOMA OF THE LARYNX *

HENRY B ORTON, M D,
Newark, N J

During the past 50 years real progress has been made in the surgical treatment of malignant disease of the laryngopharynx Formerly, the operative mortality varied enormously with the type of operation performed The operative mortality in thyrotomy was 10 to 20 per cent, 26 to 35 per cent in hemilaryngectomy, and 47 to 60 per cent in laryngectomy This high mortality rate caused Butlin, in 1887, to say that "results were so gloomy that there seemed to him to be scarcely justification for the performance of a radical operation for cancer in this area Scarcely a single case had been cured and the mortality extremely high and success surprisingly small" Such were the results in surgery in malignant disease of the laryngopharynx at the turn of the century Compare the above with the results at the present time of thyrotomy[1] with 85 to 95 per cent cured and total laryngectomy with 60 to 90 per cent[2] cured, depending upon the site of the lesion, with an operative mortality rate of 1 8 to 4 3 per cent

More than 20 years ago, Sir Wilfred Trotter[3] said "What may be our hopes about the discovery in the treatment of

---

*Read before the Canadian Otolaryngological Society Alexandria Bay N Y June 21-22 1948

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 7 1949

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St, Philadelphia, Pa

Vice President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore, Pa

Treasurer Dr Harry P Schenck, 1912 Spruce St, Philadelphia, Pa

Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Vicente Banet
Vice-Presidente Dr José Lastra
Secretario Dr René Smith
Vice Secretario Dr Luis Rodriguez Baz
Tesorero Dr Antonio Rodrigues Diaz
Vice Tesorero Dr Tomás Armstrong

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho, Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice Presidente Dr Luis E Olsen
Secretario Dr Eugenio Romero Diaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez, Dr Nondier Asis R, Dr Jorge Bergallo Yofre

THE
LARYNGOSCOPE.

VOL LIX APRIL, 1949 No 4

MANAGEMENT OF CARCINOMA OF THE LARYNX *

HENRY B ORTON, M D ,
Newark, N J

During the past 50 years real progress has been made in the surgical treatment of malignant disease of the laryngopharynx Formerly, the operative mortality varied enormously with the type of operation performed The operative mortality in thyrotomy was 10 to 20 per cent, 26 to 35 per cent in hemilaryngectomy, and 47 to 60 per cent in laryngectomy This high mortality rate caused Butlin, in 1887, to say that "results were so gloomy that there seemed to him to be scarcely justification for the performance of a radical operation for cancer in this area Scarcely a single case had been cured and the mortality extremely high and success surprisingly small " Such were the results in surgery in malignant disease of the laryngopharynx at the turn of the century Compare the above with the results at the present time of thyrotomy[1] with 85 to 95 per cent cured and total laryngectomy with 60 to 90 per cent[2] cured, depending upon the site of the lesion, with an operative mortality rate of 1 8 to 4 3 per cent

More than 20 years ago, Sir Wilfred Trotter[3] said "What may be our hopes about the discovery in the treatment of

---

*Read before the Canadian Otolaryngological Society Alexandria Bay N Y June 21-22 1948

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 7 1949

malignant disease, of methods more specific and less harsh, surgical operation must be admitted to be the most useful and trustworthy means we now possess " This statement still must stand today The pathological and clinical principles, combined with the development of surgical technique, have extended the field to which they can be applied

In this series of cases the histological structure of the malignant variety of cancer attacking the laryngopharynx, the squamous cell type predominates Regarding sex, the males predominate in the ratio of 12 to 1 The youngest patient was 13½ years of age and the oldest, 76

We are concerned with two groups of cases first, those malignancies within the larynx proper, the epilaryngeal or extrinsic cancer of the larynx, as some may wish to term it Second, those malignancies of the lateral and posterior wall of the pharynx, including the postcricoid area Lately, physicians have developed an increasing interest in the treatment of this disease, yet there are some who doubt the results of treatment by surgery and turn all cases over for irradiation This is especially true regarding the epilaryngeal type of cancers, and is causing a great deal of controversy as to their treatment It is true that these extrinsic cancers are insiduous in their onset and spread rapidly to the lymph nodes at a very early stage Some authorities say that patients are not arrested or cured by surgical operation, and should be turned over to the radiologist for deep X-ray therapy Some patients believe that operation for cancer in this area has a high mortality rate, and that they will lose their voice forever Some physicians even tell their patients that such is the case This is not true

As I have already stated, the operative mortality in my series is 1 8 per cent As to regaining speech, I am convinced that a man without his larynx can talk, whistle and smoke again, or even play a musical instrument, if he has the determination To rehabilitate the laryngectomized patients in speaking is part of our postoperative care

Surgical removal means a procedure sufficiently radical to remove the entire primary lesion The surgical treatment given one case must be governed by the type, extent of growth and its location Emotions, economics or conservatism must not be considered Conservative methods, as saving cartilage, muscles or attachments for cosmetic or functional betterment are unsurgical and unsafe in the treatment of cancer of the laryngopharynx

Diagnosis should be made early, as the growth is readily seen by direct or indirect examination, yet it is interesting to note that 58 of the 168 cases, or 34 per cent, I found were inoperable at the time of my first examination This is something to think about concerning early diagnosis Twenty-one per cent needed tracheotomy on the first visit It is true that cancer cannot be cured in all cases, but certainly if this region is examined with painstaking thoroughness much can be accomplished by earlier diagnosis and radical operation

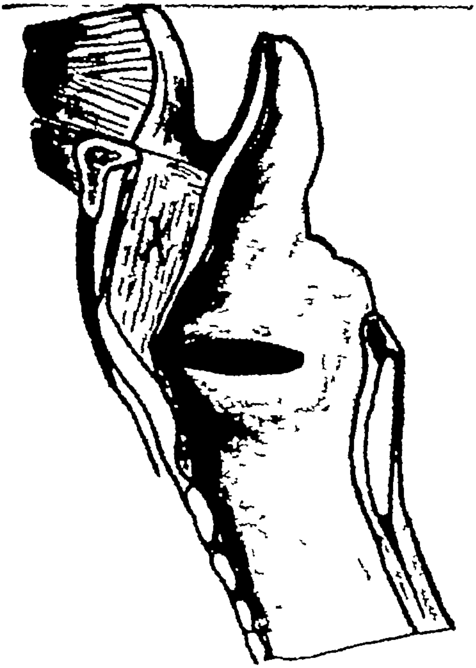


Fig 1 Drawing showing the pre-epiglottic space marked X

I[13] personally look at all biopsies with the pathologist before operating and find this cooperation most valuable New, in his observation on the microscopic extension of the tumor taken at 5, 10 and 15 mm from the apparent margin of the growth, found that the maximal extension of highly malignant tumors was 15 mm This has been brought out by Broyles and Smitman, both of whom have shown that the cancer cells have extended beyond the apparent growth histologically, in the anterior commissural tumors of the cord — an additional reason why the pre-epiglottic space is invaded early, and should be removed with the larynx I have demonstrated this invasion of the pre-epiglottic space[4] many times at operations in cancer of the epiglottis below the hyoepiglottic ligament This pre-epiglottic space, or the space of Boyer, as it is sometimes called, was described by Jean LaRoux[5] in an article published in 1936, and at the same time Tambein demonstrated histologically that cancer of the vestibule and the ventricle of Morgagni invaded the pre-epiglottic space and stated that the classical laryngectomy is insufficient for the complete eradication of cancer in these cases

The surgical procedures in malignancies of the laryngo pharynx are *1* thyrotomy or laryngofissure, *2* laryngectomy, *3* laryngopharyngectomy, *4* lateral transthyroid pharyngotomy[6-] The indications and relative merits of these various operations will now be taken up, together with the different locations of these tumors

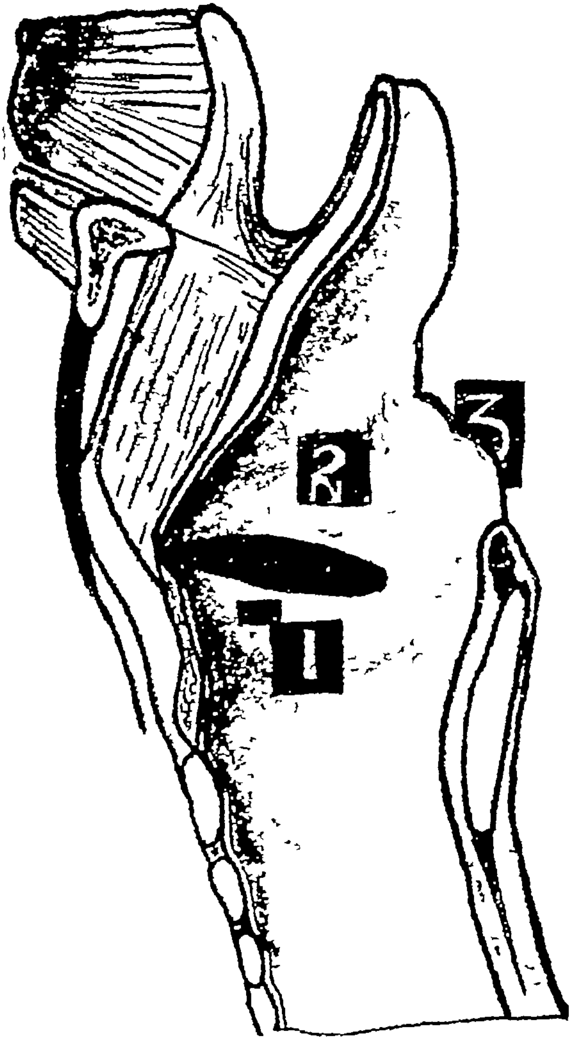
LARYNGOFISSURE OR THYROTOMY

When the growth is situated on one vocal cord, at the middle third with both extremities of the cord free from disease, and the cord not fixed, but retains its full mobility, thyrotomy is the choice operation Any fixation of the cord or arytenoid shows muscular involvement, and any conservative surgery will be inadequate In my own experience in properly selected cases for thyrotomy, the results have been 93 per cent living over five years My first thyrotomy patient, for true cordal cancer of the larynx, is still living 30 years after operation

TABLE 1 LARYNGOFISSURE OR THYROTOMY

	14		
Alive and well	9	Alive and well under 1 year	2
Died from recurrence	1	Alive and well 1 to 5 years	1
Died from other causes	4	Alive and well 10 to 30 years	6
	14		9

Successful cases nine plus four total 13 or 93 per cent cures



INTRINSIC

Fig 2 Intrinsic cancer (about 75 per cent of laryngeal cancer is intrinsic) (1) shows the vocal cord, a favorite site for intrinsic cancer which spreads along the cord and may become subglottic and spread to the opposite cord or across the commissure (2) shows the ventricular band and ventricle These are rarely involved, but their involvement is more dangerous than that of the cord causing early glandular involvement. (2) shows the interarytenoid area, which is rarely affected.

LARYNGECTOMY

The indications for this operation are

a When the growth has extended to the anterior commissure, or has extended backwards to the arytenoid cartilage

b The epiglottis is involved below the level of the hyoepiglottic ligament

c The growth has crossed to the opposite side and there is a subglottic extension

d The growth springing from the ventricle or ventricular fold

e The growth has invaded the thyroid cartilage or the cricothyroid membrane

f Definite fixation of one or both vocal cords

g The growth is subglottic in origin

h In a recurrence following a laryngofissure operation

i Where the larynx has been subjected to unsuccessful irradiation in selected cases

To be considered in these cases is the extent of the growth and its location The growths are usually of squamous type and are readily seen by direct or indirect examination of the larynx With a growth so situated as above stated, a laryngectomy is the procedure of choice

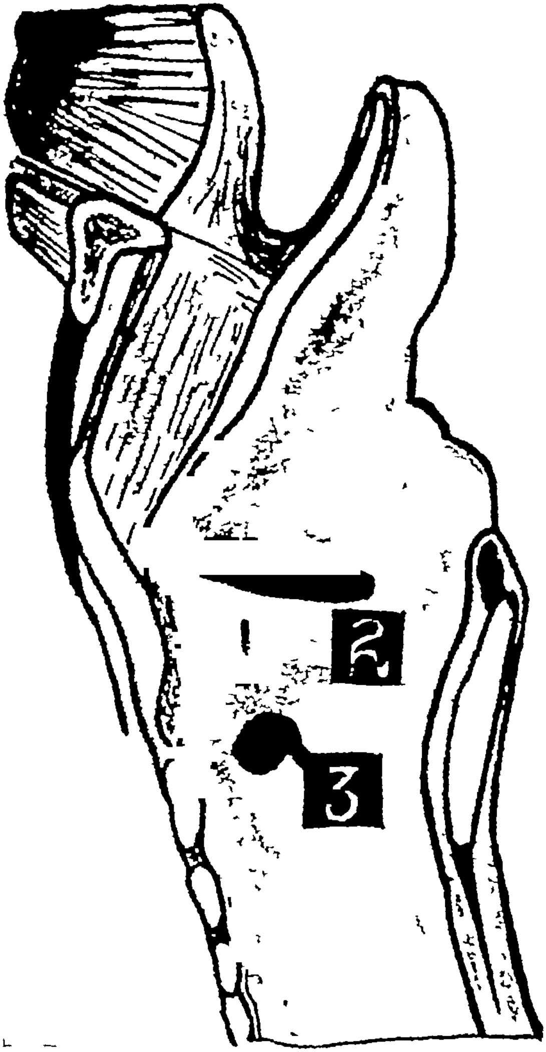
LARYNGOPHARYNGECTOMY

The surgical treatment for the epilaryngeal group or extrinsic type of cancer is more difficult, in that the entire larynx with some of the pharyngeal tissue must of necessity, accord-

TABLE 2 PHARYNGOTOMIES

	17		
Alive and well	4	Alive and well 5 to 10 years	2
Died from recurrence	6	Alive and well 10 to 15 years	2
Died from other causes	7		
	17		4

Successful cases four plus seven total, 11, or 65 per cent cures



SUBGLOTTIC

Fig 3 Subglottic cancer originates on the inner or the under surface of the vocal cords or the subglottic area (chiefly in the anterior half of this region) (1) shows intrinsic cancer of the cord becoming subglottic at the anterior commissure (2) Intrinsic cancer of the cord on the inner or under surface but below the free edge (invasion of the opposite cord is by the subglottic route or across the commissure) (3) the true subglottic cancer

ing to the site of tumor, be removed along with the larynx, with the possible exception of cancer of the epiglottis, on the laryngeal surface, above the level of the hyoepiglottic ligament If such a case presents itself, then the upper part of the epiglottis can be removed by a lateral transthyroid pharyngotomy, with excellent prospects of a lasting cure

Let us take up the different locations of these tumors of the epilaryngeal group and the proper procedure to carry out

THE EPIGLOTTIS

Some authorities say that a cancer on the edge, or on the laryngeal surface of the epiglottis, may be approached by a lateral pharyngotomy and the epiglottis excised, so as to leave the main structure of the larynx intact I shall qualify that statement by saying that the growth on the epiglottis must be above the level of the hyoepiglottic ligament since early invasion of the pre-epiglottic space is certain to take place with any growth below this level Suffice it to say that I strongly recommend that with any growth of the epiglottis below the level of the hyoepiglottic ligament, the epiglottis with the larynx and hyoid bone should be removed *in toto* This seems radical, but radical we must be if success is our goal Any growth above the level of the hyoepiglottic ligament may be removed by lateral pharyngotomy

THE ARYEPIGLOTTIC FOLDS

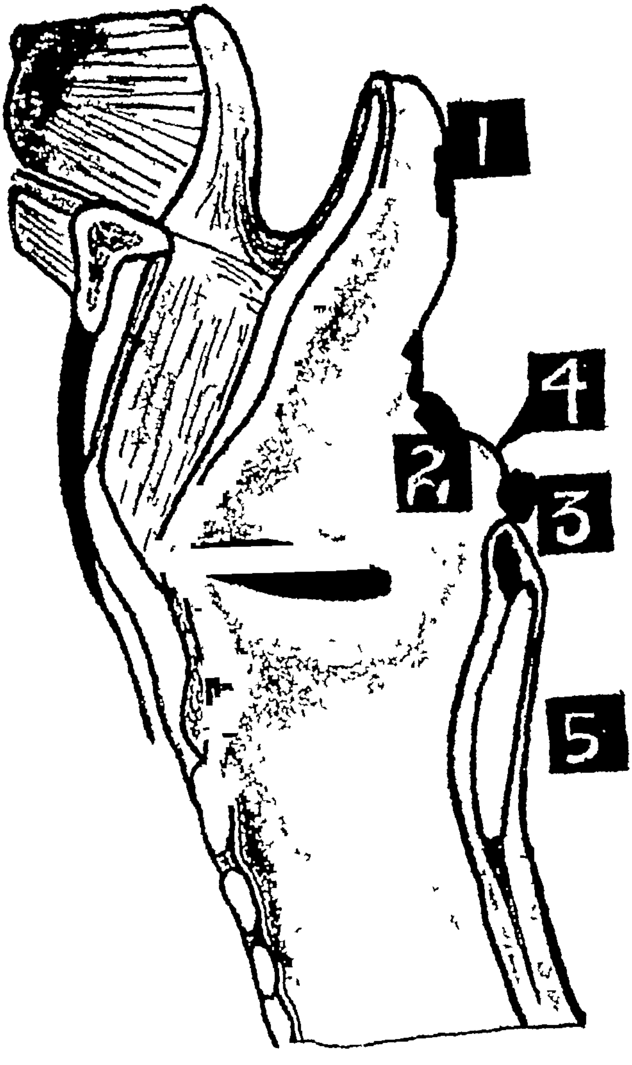
If seen very early, cancer in this region may be removed by laryngeal pharyngotomy, but usually by the time the patients present themselves for operation, the growth has already extended beyond the area for this type of operation, and we must resort to a wide excision of the larynx with the hyoid bone and pre-epiglottic space and perhaps some of the lateral wall of the pharynx

TABLE 3 LARYNGECTOMIES AND LARYNGOPHARYNGECTOMIES

220

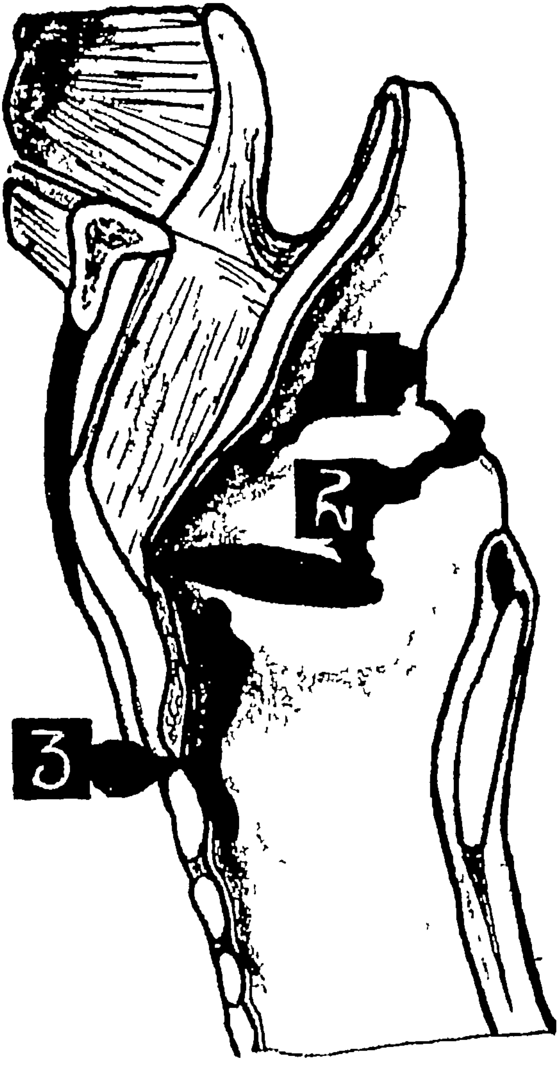
Alive and well		118	Alive and well under 1 year	21
Died within 3 wks of operation		6	Alive and well 1 to 5 years	29
Died from recurrence		54	Alive and well 5 to 10 years	31
Died from other causes		42	Alive and well 10 yrs and over	37
Lived under 5 years	17			
Lived over 5 years	25			
		220		118

Successful cases 118 plus 42 total, 160, 72 7 per cent cures



EXTRINSIC

Fig 4 Extrinsic cancer In this group are included neoplasms growing from the epiglottis the aryepiglottic folds the arytenoid cartilages the pyriform sinuses and the pharyngeal surface of the cricoid cartilage (postcricoid cancer) (1) shows the margins of the epiglottis (2) the aryepiglottic folds (3) the arytenoid cartilages (4) the pyriform sinuses (5) the pharyngeal surface of the cricoid cartilage



MIXED

Fig 5 In this class a combination of extrinsic and intrinsic must be placed a number of cases which only present themselves in an advanced stage when it is impossible to determine the site of origin (1) shows extrinsic cancer becoming intrinsic (2) intrinsic cancer becoming extrinsic (3) shows subglottic cancer becoming intrinsic and breaking through the cricoid membrane becoming extrinsic on the neck

[illegible]

Here the tumor [illegible] inner walls of the sinus [illegible] larynx that nothing [illegible] the hyoid bone and [illegible] Even a node resection [illegible] this procedure

THE LATERAL [illegible]

This type of tumor [illegible] pharyngotomy, preceded [illegible] operation, preferabl [illegible] at a later date if necess[illegible]

[illegible]

If seen very early [illegible] construction following [illegible] cord is fixed and the [illegible] laryngopharyngectomy [illegible]

The operation of lateral [illegible] for inspection and removal [illegible] pharynx, however, [illegible] fissure operation [illegible] pharyngotomy is only [illegible] of the lateral and [illegible] glottis as mentioned [illegible] cells is at present [illegible] the only perma- nent cure, whether [illegible] of all cancer [illegible] biological change [illegible] destruction or by some

[illegible]

The management of [illegible] of the larynx with metastatic involvement of [illegible] could mean metastatic involvement of the neck at the same time that the larynx is involved, or it could mean metastatic involvement following laryngectomy. Naturally, from the epilaryngeal and hypopharyngeal groups where the lymph drainage is free, we have, therefore, early meastasis to the regional lymph nodes It is well to know the anatomy of the lymphatic drainage from this area, however, we must remember that in the early cases these nodes may or may not be carcinomatous

LYMPHATICS

The submaxillary glands drain the side of the tongue along with other parts of the face, therefore, with any involvement of the posterior part of the tongue, from the lingual surface of the epiglottis, the submaxillary gland with its nodes should be removed

DEEP SET OF CERVICAL GLANDS

A The infrahyoid glands These lie on the thyrohyoid membrane and drain the front of the larynx It is important to remove the pre-epiglottic space in laryngectomy

B The prelaryngeal glands These lie on the cricothyroid ligament draining the larynx

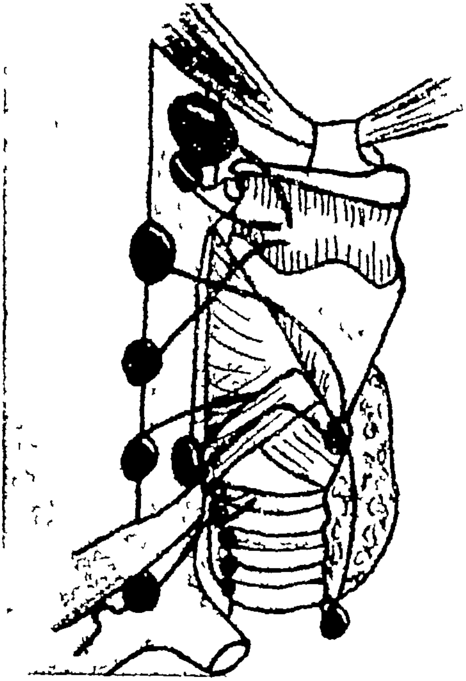


Fig 6 Drawing showing lymphatic drainage of larynx.

Trotter has shown that their afferents pass through a small foramen in the middle of the cricothyroid ligament In cancer of the larynx these glands are often the first to become enlarged, they also assist in drainage of the thyroid It is wall, therefore, to remove the cricoid cartilage with the larynx The deep cervical chain receives ultimately all the lymph from the sections above mentioned This deep cervical chain consists of a number of large glands lying in relation to the carotid sheath A few of these occupy an outlying position behind the pharynx This deep chain lies along the side of the pharynx, trachea and esophagus, and extends from the base of the skull to the root of the neck These are divided into the superior and inferior by the point of bifurcation of the common carotid or the crossing of the omohyoid muscle Both are in close relationship with the internal jugular vein, and in removing them it is necessary to strip them from the vein, or better, to remove the jugular vein along with them Some of the glands of the inferior group project beyond the posterior border of the sternomastoid into the posterior triangle of the neck There are a few glands of this group that lie in the groove between the trachea and esophagus and drain the thyroid paratracheal glands A large gland, situated below the angle of the jaw between the internal jugular and facial veins, is known as the main gland of the tonsil Another large gland at the bifurcation of the carotid just below the cornua of the hyoid bone, is called the main gland of the tongue Finally, a large gland on the carotid where the anterior belly of the omohyoid muscle crosses it, is known as the supra omohyoid gland

The main gland of the tongue, in cancer of the larynx involving the base of the tongue, is the one that enlarges so rapidly postoperatively, and in many cases this gland may be removed and followed by irradiation The dissection of the neck should take in the area from the angle of the jaw and tip of the mastoid downwards to below the posterior belly of the omohyoid muscle, removing the jugular vein, submaxillary gland, fascia, hyoid bone with the infrahyoid muscles and larynx en masse, and part of the thyroid gland if needed

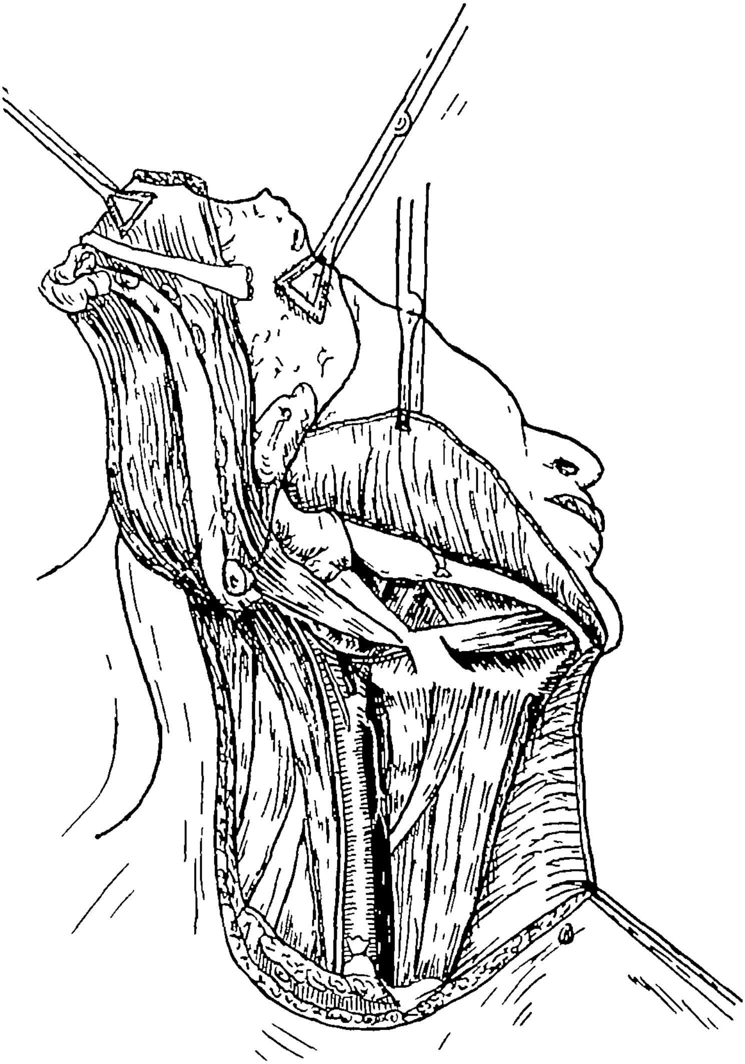


Fig 7 Drawing of block resection of the neck showing structures to be removed in metastasis of lymph nodes

This is what Brunschwig[3] calls a panlaryngectomy We must remember that the flow of lymph following a resection may have a retrograde movement and involving the glands in the postauricular area, posterior triangle of the neck ending in the retropharyngeal glands With involvement of the base of the tongue from the lingual portion of the epiglottis, we must remember that the cancer cells in the tongue may pass readily from one side to the other, from this it becomes necessary to deal with both sides of the neck When we have a patient who has the entire length of the deep cervical chain of lymphatic glands involved in a fixed, hard, firm mass, extending to a point below the infrahyoid muscle, it is needless to say that we cannot expect to cure the cancer By that time the cells have already entered the thoracic duct and into the general blood stream

In the lateral transthyroid pharyngotomy, a block resection of glands and fascia is done before the pharynx is opened to attack the growth adjacent to the larynx.

In advanced laryngeal carcinoma with movable cervical nodes, a wide T-incision is made, the same resection of glands and fascia is done, and the larynx, hyoid bone with the infrahyoid muscles attached to the larynx and the necessary part or all of the lower pharynx is removed en masse The raw surface is covered with skin, leaving an upper and a lower stome, which must be closed later by one or more plastic operations for the reconstruction of the pharynx and upper esophagus These wide incisions are necessary for proper radical surgery in these cases and none should attempt to do this type of surgery by any narrow field This wide incision gives one the extensive exposure to the area Often nodes are seen that were not palpable preoperatively, and when found, proper care can be given them New has also reported excellent results by the use of electrocoagulation in selected cases of advanced laryngeal and pharyngeal cancer

In these operations we have procedures amenable to a possible cure, if not a cure, then certainly an appreciable palliative control of the disease In these extensive laryngectomies, pharyngotomies or laryngopharyngectomies, one must have a good knowledge of the extent of the growth, made possible by X-ray and direct examination, before operation, then the type of operation decided upon and the basic steps carried out A thorough knowledge of the anatomy of the neck is a prerequisite for successful surgery. One may begin with a lateral transthyroid pharyngotomy and upon opening the pharynx finds it necessary to change his operation to extensive laryngopharyngectomy, with reconstruction of the entire cervical esophagus. The surgeon must be able to meet and change his procedure as conditions present themselves during the operation. When one describes the various steps of any of these operations, only the general basic principles can be explained. The shock of these operations is not so severe as one would expect and with the use of penicillin and sulfadiazine therapy, operative mortality is reduced to almost nil.

Treatment by irradiation has been widely studied in the treatment of laryngeal and pharyngeal carcinoma and is very interesting. Unfortunately, the results of the treatment do not lend themselves to satisfactory comparison, and the subject is not sufficiently advanced to be reviewed historically. For instance, the type of case in which the radiologists promise[10] most is that type of intrinsic cancer limited to one cord. It is in this type of case that the lasting benefits of treatment by surgery are well established, and the percentage of cures by surgery far surpasses those cured by irradiation. To me, in all cases where surgery can hold out good promise of lasting cure, it still must be given the preference. When the extent or nature of the disease, or the age of the patients are contraindications, then irradiation should be given a trial. It is commonly supposed[9] that the use of some form of irradiation has greatly simplified the treatment of cancer of the larynx and pharynx. This supposition is erroneous. It has given us a new and a very powerful addition to our means of attack, but, far from simplifying the attack, it has been made more than ever dependent upon experienced judgment and expert handling. It is posible even today that total results as to cure or notable periods of freedom from recurrence are actually worse for the introduction of irradiation, since it seems likely that many patients who might have had a good chance of cure by operation in competent hands have had this chance shattered by ineffective irradiation treatment. This may be only a transit phase, for a proper appreciation of the technical requirements of sound irradiation therapy is already replacing the cruder view and in time must result in the full benefits of irradiation being made manifest. I am absolutely in accord with Colledge when he states, "As the results of irradiation, however, are so impossible to predict and the results at the and of three to five years so poor that I have abandoned it for every operable case, and only recommend it when the operation is refused or the case is inoperable. It is then a useful palliative measure and the growth often disappears for some months, but the lasting results are few." The claims of the radiologist now complicate the picture. These claims are often exaggerated, however, they may not be without good foundation. The surgeons use a five-year period as their basis for success, whereas the radiologists do not. Most of their claims are based on the fact that the cases best suited for radiology are the very ones that are best suited for surgery, and in the inoperable cases when surgical treatment is more difficult, the radiologist has very little success. True palliative results may be obtained, but patients are often made worse by perichondritis and radionecrosis. The tables herein presented are used to substantiate the above statements.

CONCLUSIONS

It is difficult to compare and appraise vital results, they are often incompletely recorded, some surgeons decline doubtful cases and will accept only those which promise definite results. The difficulty and disagreements seem to be about the so-called extrinsic type of case. According to reports, there seems to be a controversy between operation and irradiation. With the incomplete reports of irradiation where the radiologist claims beneficial results, the erroneous belief has arisen that almost all, if not all, cases of extrinsic cancer should be irradiated in preference to surgery, and that the radiologist should be consulted as to the advisability of irradiation before surgery is attempted. Such fallacy I have attempted to show in my tables. I feel that surgery still holds a very important place in the battle against extrinsic cancer of the larynx and pharynx. This statement has been confirmed by others who are doing extensive neck surgery.

TABLE 4 EXTRINSIC CANCER OF THE LARYNX

110 Cases of Extrinsic Cancer of the Larynx and Pharynx Operated Upon or Given Some Form of Irradiation Showing Results by Years

	Radiation	Radiation Years					Surgery	Surgery Years				
Site of Cancer	No	1	2	3	4	5	No	1	2	3	4	5
Epiglottis	9	7	1	0	1	0	12	3	1	1	2	5
Epiglottic fold	11	9	2	0	0	0	13	7	3	1	0	2
Arytenoid	7	5	2	0	0	0	6	2	1	1	0	2
Pyriform sinus	25	22	3	0	0	0	20	8	6	1	0	5
	52	43	8	0	1	0	51	20	11	4	2	14
Radiation three years and over, 1 Over five years, 0												
Surgery three years and over, 39 per cent Over five years, 27 per cent												
Postcricoid	0	0	0	0	0	0	16	10	4	0	0	2
Lateral wall pharynx	0	0	0	0	0	0	13	6	2	2	1	2

TABLE 5 COMBINED RECAPITULATION
251 MAJOR OPERATIONS NOT INCLUDING 51 TACHEOTOMIES

OPERATIVE MORTALITY 1 9 PER CENT

		Died from other causes who	
Alive and well under 1 year	27	Lived under 1 year	20
Alive and well 1 to 5 years	42	Lived from 1 to 5 years	9
Alive and well 5 to 10 years	25	Lived from 5 to 10 years	9
Alive and well over 10 years	37	Lived 10 years and over	15
	131		53

Alive and well	131
Died from other causes	53
Successful cases	184 or 73 per cent cures

When we consider in general the results by surgery, it is fair to ask ourselves what are the results without surgery At the present time two conclusions present themselves first, we have technical methods which seem soundly established and capable of progressive refinement and extension, second, we can say that in cases carefully but not too rigorously selected as favorable, we can look for satisfactory results as to the disease, cures by drastic but not very dangerous operations which have no serious disability I cannot agree with the statement that these operations are mutilating In our follow-up we rehabilitate the laryngectomized patient in the use of the esophageal or pharyngeal voice It is gratifying to see how very promptly these patients readjust themselves, returning to their former occupations and enjoying life

The preoperative and postoperative care of these patients is of utmost importance It is only with the meticulous care and the coordinated efforts of the surgeon, pathologist, anesthetist, assistants and nurses that it is possible to show the results as I have These operations are not one man's work, they involve teamwork of the highest type, and it is this team's work that shows the low mortality rate

I believe that radical surgery saves many lives that would have been sacrificed if more conservative forms of surgery had been performed, and I still believe that more lives can be saved by surgery, if diagnosis is made earlier in the epilaryngeal or extrinsic cancer of the laryngopharynx.

BIBLIOGRAPHY AND REFERENCES

1 THOMSON SIR ST CLAIR History of the Laryngoscope THE LARYNGOSCOPE. London XV Mar., 1905 p 177

2 THOMSON SIR ST CLAIR *Trans Seventeenth Internat Med Cong.,* London 111 197 1881.

3 BRUNSCHWIG ALEXANDER Further Experiences with Panlaryngectomy for Advanced Carcinoma of the Larynx. *Jour Surg Gynec and Obst* 83 5 342-639 1946

4 BISI, RICARDO H. Cancer Laringes su Tratamiento Quirurgico El Tteneo Buneos Aires 1938

5 ROBERT JEAN LAROUX Les Epitheliomes Endolarynges

6 ORTON HENRY B Cancer of the Larynx. *Arch Otolaryngol* 28 153-193 Aug. 1938

7 ORTON HENRY B Lateral Transthyroid Pharyngotomy *Arch Otolaryngol.,* 12 320-338 Sept. 1930

8 TROTTER WILFRED Purvis Oration on the Surgery of Malignant Disease of the Pharynx. *Brit Med Jour.,* 1 269 Feb 13 1926 A Method of Lateral Pharyngotomy for Exposure of Large Growth in the Epilaryngeal Region. *Jour Rhinol., Otol and Laryngol.,* 35 289 Oct. 1920

9 COLLEDGE, LIONEL *Trans Med Soc* Vol LXIII London 1943

10 LENZ, MAURICE Causes of Failure of Roentgen Therapy in Cancer of the Larynx. *Amer Jour Roent.,* XLVI 1 July 1941

TABLE 4 EXTRINSIC CANCER OF THE LARYNX

140 Cases of Extrinsic Cancer of the Larynx and Pharynx Operated Upon or Given Some Form of Irradiation Showing Results by Years

Site of Cancer	Radiation No	Radiation Years 1	2	3	4	5	Surgery No	Surgery Years 1	2	3	4	5
Epiglottis	9	7	1	0	1	0	12	3	1	1	2	5
Epiglottic fold	11	9	2	0	0	0	13	7	3	1	0	2
Arytenoid	7	5	2	0	0	0	6	2	1	1	0	2
Pyriform sinus	25	22	3	0	0	0	20	8	6	1	0	5
	52	43	8	0	1	0	51	20	11	4	2	14

Radiation three years and over, 1 Over five years, 0

Surgery three years and over, 39 per cent Over five years, 27 per cent

Site of Cancer	Radiation No	Radiation Years 1	2	3	4	5	Surgery No	Surgery Years 1	2	3	4	5
Postcricoid	0	0	0	0	0	0	16	10	4	0	0	2
Lateral wall pharynx	0	0	0	0	0	0	13	6	2	2	1	2

TABLE 5 COMBINED RECAPITULATION
251 MAJOR OPERATIONS NOT INCLUDING 51 TACHEOTOMIES

OPERATIVE MORTALITY 1 9 PER CENT

		Died from other causes who	
Alive and well under 1 year	27	Lived under 1 year	20
Alive and well 1 to 5 years	42	Lived from 1 to 5 years	9
Alive and well 5 to 10 years	25	Lived from 5 to 10 years	9
Alive and well over 10 years	37	Lived 10 years and over	15
	131		53

Alive and well	131	
Died from other causes	53	
Successful cases	184	or 73 per cent cures

When we consider in general the results by surgery, it is fair to ask ourselves what are the results without surgery At the present time two conclusions present themselves first, we have technical methods which seem soundly established and capable of progressive refinement and extension, second, we can say that in cases carefully but not too rigorously selected as favorable, we can look for satisfactory results as to the disease, cures by drastic but not very dangerous operations which have no serious disability I cannot agree with the statement that these operations are mutilating In our follow-up we rehabilitate the laryngectomized patient in the use of the esophageal or pharyngeal voice It is gratifying to see how very promptly these patients readjust themselves, returning to their former occupations and enjoying life

The preoperative and postoperative care of these patients is of utmost importance It is only with the meticulous care and the coordinated efforts of the surgeon, pathologist, anesthetist, assistants and nurses that it is possible to show the results as I have These operations are not one man's work, they involve teamwork of the highest type, and it is this team's work that shows the low mortality rate

I believe that radical surgery saves many lives that would have been sacrificed if more conservative forms of surgery had been performed, and I still believe that more lives can be saved by surgery, if diagnosis is made earlier in the epilaryngeal or extrinsic cancer of the laryngopharynx

BIBLIOGRAPHY AND REFERENCES

1 Thomson, Sir St Clair History of the Laryngoscope The Laryngoscope, London, XV Mar , 1905 p 177

2 Thomson, Sir St Clair *Trans Seventeenth Internat Med Cong* , London 111 197 1881

3 Brunschwig Alexander Further Experiences with Panlaryngectomy for Advanced Carcinoma of the Larynx *Jour Surg Gynec and Obst* , 83 5 342 639 1946

4 Bisi, Ricardo H Cancer Laringes su Tratamiento Quirurgico El Tteneo Buneos Aires, 1938

5 Robert Jean LaRoux Les Epitheliomes Endolarynges

6 Orton, Henry B Cancer of the Larynx *Arch Otolaryngol* 28 153 193, Aug 1938

7 Orton Henry B Lateral Transthyroid Pharyngotomy *Arch Otolaryngol* 12 320 338 Sept. 1930

8 Trotter Wilfred Purvis Oration on the Surgery of Malignant Disease of the Pharynx *Brit Med Jour* 1 269 Feb 13 1926 A Method of Lateral Pharyngotomy for Exposure of Large Growth in the Epilaryngeal Region *Jour Rhinol Otol and Laryngol* 35 289 Oct. 1920

9 Colledge Lionel *Trans Med Soc* Vol LXIII London 1943

10 Lenz Maurice Causes of Failure of Roentgen Therapy in Cancer of the Larynx. *Amer Jour Roent* XLVI 1, July 1941

11 MARTIN, HAYES Surgery of the Nose and Throat New York Thomas Nelson Kernan Sons, 1942, V 431 507

12 BRADY, JOHN V, and CHAMBERLAIN, W EDWARD Treatment of Cancer of the Larynx by Roentgen Irradiation *Amer Jour Roent*, LI 4

13 ORTON, HENRY B Pathology and Surgery of Extrinsic Cancer of the Larynx American Laryngological Association, St Louis, Mo, Apr 23, 1947

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETS AT ST LOUIS, SEPT 28, 29, 30, 1949

The Fourteenth Annual Meeting of the Mississippi Valley Medical Society will be held at the Jefferson Hotel, St Louis, Mo, Sept 28, 29, 30, 1949, under the presidency of Dr Alphonse McMahon, of St Louis University At the recent current meetings of the Society and board of directors, the following officers were elected Dr Nathaniel G Alcock, Iowa City, Iowa, President-elect, Dr Wendell G Scott, St Louis, Mo, First Vice-President, Dr Charles F Harmon, Springfield, Ill, Second Vice-President, Dr John I Marker, Davenport, Iowa, Third Vice-President, Dr Harold Swanberg, Quincy, Ill, Secretary-Treasurer, Dr Ralph McReynolds, Quincy, Ill, Accounting Officer

---

INTERNATIONAL CONGRESS OF OTOLARYNGOLOGY, LONDON, 1949

The British Association of Otolaryngologists is organizing the Fourth International Congress of Otolaryngology, to be held in London from July 17 to July 23, 1949 There will be further meetings, for those who wish to go, at Oxford, Cambridge and Edinburgh on July 25 and 26 It is hoped that a full academic program will be arranged, and also various social functions

The secretaries of the National Otolaryngological Societies have been circularized and asked to send a list of their members for individual notification Should any association not receive this letter, they should communicate with the General Secretary, F C W Capps, F R C S, 45, Lincoln's Inn Fields, London, W C 2

THE ROLE OF THE UPPER RESPIRATORY MUCOUS MEMBRANE IN THE PATHOGENESIS OF POLIOMYELITIS *

W LLOYD AYCOCK, M D (by invitation),
Boston, Mass

Clinically, there is an unbroken gradation from frank paralytic poliomyelitis through milder and nonparalytic forms to suspected abortive infections There are epidemiological space and time relationships between clinically recognized cases which imply intervening milder infections or "healthy" carriers There is an extensive development of immunity in the general population, as shown by virus neutralization tests, and finally, the virus is actually detected not only in recognized cases but also in milder suspected illnesses and healthy individuals All these observations afford conclusive evidence to the effect that the virus is widely disseminated and that the paralytic disease is the exceptional manifestation of infection with the virus, furthermore, there are reasons for believing that this exceptional but serious consequence in what is ordinarily an entirely benign and trivial virus infection may be determined not so much by the circumstances of exposure to the virus but by factors which make for susceptibility in a certain few of the many who are exposed

As long ago as 1910, Sheppard, having in mind a "tonsillectomy campaign" which coincided with an epidemic of poliomyelitis, and citing one case, included tonsillectomy as one of

---

*Read at the meeting of the Eastern Section American Laryngological Rhinological and Otological Society Inc. Boston Mass Jan 7 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication Jan 19 1949

a number of possible predisposing circumstances in the causation of poliomyelitis As is frequently true of diseases of the locomotor system, stresses, strains and traumas were most in favor as contributing causes Many such circumstances were noted from the most trivial to the most severe accidents, and those ranging in time from the moment of detection of the illness to as far back as the memory extended Attention was focused most sharply upon circumstances immediately preceding the illness, and indeed many of the falls or injuries noted, rather than being preceding circumstances, were perhaps the result of the already present but unrecognized disease

It is not surprising, then, that surgical injury of the nasopharyngeal mucous membrane, but one of the many preceding circumstances which were being considered as of possible etiologic interest, did not at this time become the subject of more exhaustive study, nevertheless, Sheppard seemingly intuitively singled out tonsillectomy from the heterogeneous groups of wounds, falls, injuries, exposures, overexertions and so forth when he wrote "It might be reasonable to suggest at this time that tonsil and adenoid tissue may offer a resistance to microbic invasion If this is the case, it might seem on *a priori* grounds injudicious to remove an inflamed tonsil, especially in the presence of an acute epidemic infection characterized in many instances by involvement of the upper respiratory passage " Occasional cases subsequently mentioned in the literature as occurring at suspiciously brief intervals following tonsillectomy have usually been explained by conjectures such as, that the surgeon himself might have been a "carrier" of the virus and infected his patient

In 1929, Ayer reported "as of possible import in the epidemiology of poliomyelitis" the observation of nine cases of bulbar poliomyelitis which followed tonsillectomy by from five to 10 days At the same time, Aycock and Luther reported a controlled study which revealed an unmistakable relationship between tonsillectomy and the occurrence of poliomyelitis, in that an excessive number of cases of bulbar poliomyelitis were found to have occurred at a specific time interval following the operation Of 714 cases, 217, or 30 per cent, had had a tonsillectomy at some time By comparison with other estimates for school children of corresponding ages, it did not appear that either presence or absence of tonsils was a predisponent to poliomyelitis, however, a disproportionate number of the poliomyelitis patients who were studied had had the operation within a year of the onset of the disease, and of these, a disproportionate number had had the operation within a month of the onset of the disease Of the 16 cases in this latter group, all had had the operation between seven and 18 days before the onset of their illness, furthermore, all these cases were of the bulbar type, which, in general, comprises only something like 10 to 15 per cent of reported cases of poliomyelitis Finally the interval of time between the operation and onset of the disease agreed exactly with the length of the incubation period of the disease

Thus, the relationships here were such, in the light of epidemiologic knowledge of the disease, particularly that related to the widespread occurrence of subclinical infection (or harmless harborage) of the virus, that they could only be interpreted as indicating that in an individual harboring the virus the surgical procedure sometimes initiated the clinical disease to become manifest in the bulbar form after the incubation period characteristic of the disease

Since these earlier reports appeared, almost every sizeable series of cases of poliomyelitis includes a small, to be sure, but nonetheless significant proportion of cases of the type under discussion For example, Eley and Flake in 1938, made a study of recent tonsillectomy in 418 consecutive patients with poliomyelitis admitted to the Infants' and Children's Hospitals of Boston They found that of the 287 spinal cases, eight, or 2 7 per cent, had had tonsillectomy at some time within 30 days — seven, eight, 10, 24, 25, 26, 29 and 30 days — preceding the onset of the disease In striking contrast, 17, or 13 per cent, of 131 bulbar cases had had tonsillectomy — all between the tenth and twentieth day preceding onset of the disease, yet, in 1948, opinion varies all the way from the point of view that there is no relationship between tonsillectomy and poliomyelitis to the belief that all surgical procedures on the upper respiratory passages should be suspended during the "poliomyelitis season"

As a matter of fact, the two diametrically opposed points of view seem to take their origin not so much in any divergent evidence as in convictions stemming, on the one hand, from a willingness to put any precautionary measure against poliomyelitis before other medical considerations, and on the other hand, an unwillingness to let anything interfere with convenience, if we are to believe such often heard statements as "getting ready for school" applied to the operation

From the nature of the situation, with a very sizeable proportion of the population experiencing a tonsillectomy at one time or other and only a very small fraction of the population ever suffering an attack and an even smaller fraction suffering the bulbar form of poliomyelitis, any actual association between the two would not be strikingly apparent in even a very large series of tonsillectomies, while it might easily be seen in a much smaller series of cases of poliomyelitis In other words, one could do many tonsillectomies without encountering such a case, but one would not have to see many cases of poliomyelitis before seeing bulbar cases following the operation by a specific interval

Furthermore, the evidence usually obtained in any statistical survey may not be at once convincing for the reason that the hazard of the disease in recently tonsillectomized individuals is numerically small, even though much larger than in the population in general In large surveys, such as the one conducted by Dr Cunning in 1946-1947, the excess in the frequency of recent tonsillectomy in bulbar cases over that in spinal cases and the excess in the frequency of tonsillectomy over a large assortment of other "surgical" procedures when distributed over a period of 60 days amounts to a statistical dilution which makes it not at all impressive Had these studies gone one step further to test the crucial question whether tonsillectomy preceding bulbar cases was significantly concentrated at around 14 days preceding the disease, the question of a relationship would have been settled

Thus, the question of the relationship and what measures to take becomes an annual debate, generally between otolaryngologists and poliologists — not so much because of any fundamental disagreement between them, but because they are looking at the same problem from such widely divergent angles At the same time, there is a tendency toward continued study by broad population survey methods which, by their very nature, are not likely to afford an answer to the question which would be any more decisive (because any differences shown by them are likely to be fractional) than are the few detailed studies which are already available—or better still, than the clinical experience seen in any sizeable number of cases of poliomyelitis, as for example, the group studies by Eley and Flake

On the other hand, surveys of the question limited to periods of time and to places where poliomyelitis is prevalent do bring to the surface a numerical risk which is largely hidden in the more general survey figures Such information is of value in affording an actual numerical basis for any "policy" with reference to the institution of precautionary measures

One such survey is that of Anderson In 1943, an epidemic of poliomyelitis occurred in Utah, in which the attack rate exceeded that of any other state that year As a result of certain local circumstances, practically all cases (136 out of a total of 400) reported by physicians as bulbar or respiratory were admitted to one hospital About one-third of these were of the bulbar or bulbospinal type The frequent history of recent tonsillectomy in these bulbar cases led to a study of the relationship in the ascending part of the whole epidemic in the state During the three-month period (July, August, September), 4,199 tonsillectomies were performed in the child population under 16 Seventeen of these individuals developed poliomyelitis of the bulbar or bulbospinal type within 30 days following the operation During the same period, 232 [illegible] and based on information and recommendations furnished by the State Health Department upon any [illegible] in prevalence of the disease in any of the various areas served by the hospitals

The adoption of one other more general practice in respect to the timing of the operation suggests itself From a comparison of the seasonal frequency of poliomyelitis in general and bulbar poliomyelitis following tonsillectomy, it can be inferred that there is a sort of "seasonal epidemic" in tonsillectomy which happens to coincide closely with that of poliomyelitis This, in a sense, tends to double the risk at the particular season and suggests that this favorite time for the operation, unless there be some distinct contraindication, be changed, for example, from late summer "before school opens" to early summer "after school closes," but before poliomyelitis begins

Another aspect of the tonsil-poliomyelitis relationship, one which has received far less attention, should be mentioned, in that it shows the very definite influence of the tonsil on an infectious process Without any relationship to the tonsillectomy operation itself, the data in all of the surveys which have covered this point show that the absence of tonsils favors the occurrence of the bulbar rather than the spinal form of the disease This does not mean, however, that the absence of tonsils necessarily predisposes one to the disease The survey by Top and Vaughan, in Detroit, suggests that the incidence of poliomyelitis may be higher in tonsillectomized individuals, but most of the surveys do not lend themselves to analysis of this question It is clear that the presence or absence of tonsils has a definite influence on the type of the disease which is to occur Perhaps this is more strikingly shown in an analysis of multiple cases in families where cases of both types occurred at the same time In such a situation many epidemiologic factors can be assumed to be the same The cases are in all probability the result of exposure to a single strain of virus Environmental circumstances are, in general, the same and can be excluded as determining factors In 46 families where two or more cases occurred, it was found that of 25 bulbar cases tonsillectomy had been performed recently or previously in 17, while in 76 spinal cases only 10 had been tonsillectomized at any time previously It is not meant to imply that the data in these surveys in any sense comprise any argument against tonsillectomy in general, but it is presented as a clear indication that the tonsil has a definite influence on the infectious process

Perhaps it should be emphazised that the relationship between tonsillectomy and poliomyelitis plays a relatively small part in the epidemiology of poliomyelitis In other words, complete compliance with any precautionary measure which may be indicated by these studies could result in the prevention of only a small proportion of cases of the disease I think of more far-reaching importance in the study of the disease is the fact that the occurrence of the bulbar type of the disease after tonsillectomy and with greater frequency in tonsillectomized persons affords the most striking illustration which is available of the epidemiologic principle that the frank paralytic disease in the few of the many who are exposed to the virus may be determined more by circumstances in the host than in the circumstances of exposure to the virus

It is believed that a closer study should be made in the field of otolaryngology of the as yet unexplained mechanism through which the tonsil relationships play a part in susceptibility to poliomyelitis A clearer understanding of the manner in which the tonsil influences susceptibility in a small fraction of cases might well give some indication of the nature of other factors which play a part in susceptibility

BIBLIOGRAPHY

1 ANDERSON J A Poliomyelitis and Recent Tonsillectomy *Jour Pediat*, 27 68 July 1945

2 AYCOCK, W L and LUTHER H The Occurrence of Poliomyelitis Following Tonsillectomy *N Eng Jour Med* 200 164 Jan 1929

3 AYCOCK W L Tonsillectomy and Poliomyelitis I — Epidemiologic Considerations *Med* 21 65 Feb, 1942

4 Ayer, W D Poliomyelitis *Inter State Postgrad Med Assem N Amer, 1928 Atlanta Proc*, 319, 1929

5 Cline, S Poliomyelitis and Tonsillectomy, Is There a Relationship? *Eye, Ear, Nose and Throat Mon*, 25 444, Sept, 1946

6 Cunning, D S Tonsillectomy and Poliomyelitis *Ann Otol, Rhinol and Laryngol*, 55 583, Sept, 1946

7 Cunning, D S Tonsillectomy and Poliomyelitis *Trans Amer Otologist, Laryngologist and Rhinologist Soc, Eng*, p 439, 1947

8 Eley, R C, and Flake, C G Acute Anterior Poliomyelitis Following Tonsillectomy and Adenoidectomy, with Special Reference to the Bulbar Form *Jour Pediat*, 13 63, July, 1938

9 Fischer, A E, and Stillerman, M Acute Anterior Poliomyelitis in New York in 1935, A Review of 686 Cases *Amer Jour Dis Child*, 54 984, Nov, 1937

10 Fischer, A E, Stillerman, M, and Marks, H H Relation of Tonsillectomy and of Adenoidectomy to Incidence of Poliomyelitis, with Special Reference to Bulbar Form *Amer Jour Dis Child*, 61 305, Feb, 1941

11 Francis, T, Jr, Krill, C E, Toomey, J A, and Mack, W N Poliomyelitis Following Tonsillectomy in Five Members of a Family *Jour A M A*, 119 1392, Aug 22, 1942

12 Helms, K, and Willcocks, W J The 1937 1938 Epidemic of Acute Anterior Poliomyelitis in New South Wales, with Special Reference to the Change in Age Incidence, Poliomyelitis During Pregnancy and Poliomyelitis Following Tonsillectomy *Med Jour Australia*, 1 467, Apr 19, 1941

13 Howard, R E Relationship of Poliomyelitis and Tonsillectomy *Ann Otol, Rhinol and Laryngol*, 53 15, Mar, 1944

14 Koskoff, Y D, Amshel, J, and Lebeau, S Bulbar Poliomyelitis Following Tonsillectomy and Adenoidectomy, Report of Two Cases *Arch Pediat*, 56 19 Jan 1939

15 Krill, C E, and Toomey J A Multiple Cases of Tonsillectomy and Poliomyelitis *Jour A M A*, 117 1013, Sept 20, 1941

16 Lucchesi, P F, and LaBoccetta, A C Relationship of Tonsils and Adenoids to Type of Poliomyelitis, Analysis of 432 Cases *Amer Jour Dis Child*, 68 1, July, 1944

17 Page, J R Tonsillectomy and Poliomyelitis, One Case of Poliomyelitis Following 8,915 Tonsillectomies *Arch Otolaryngol*, 39 323, Apr, 1944

18 Pedersen, P M A Statistical Study of Poliomyelitis in Relationship to Tonsillectomy *Ann Otol, Rhinol and Laryngol*, 56 281, June, 1947

19 Roberts, E R Tonsillectomy and Poliomyelitis *Ann Otol, Rhinol and Laryngol*, 55 592, Sept, 1946

20 Sabin, A B Experimental Poliomyelitis by the Tonsillopharyngeal Route, with Special Reference to the Influence of Tonsillectomy on the Development of Bulbar Poliomyelitis *Jour A M A*, 111 605, Aug 13, 1938

21 Seydell, E M Relation of Tonsillectomy to Poliomyelitis *Trans Sec Laryngol, Otol and Rhinol, A M A* p 187, 1941, *Arch Otolaryngol* 35 91 Jan, 1942

22 Stillerman M and Fischer A E Acute Bulbar Poliomyelitis Following Recent Tonsillectomy and Adenoidectomy *Am Jour Dis Child*, 56 778 Oct 1938

23 Toomey J A and Krill C E Tonsillectomy and Poliomyelitis

TWO CASES OF ACUTE DIFFUSE LABYRINTHITIS FOLLOWING ACUTE OTITIS MEDIA[*][†]

HARRY ROSENWASSER, M D ,
New York, N Y

Fifteen years ago, Dr Friesner and I[1] published a paper entitled, "Treatment of Labyrinthitis," in which we presented the historical background, reviewed the literature and set forth our viewpoint in the treatment of all forms of labyrinthine infections At that time, we stated that, despite the voluminous literature with its innumerable reports of cases, wide differences of opinion existed regarding surgical therapy in some forms of labyrinthine disease We reserved for the last the consideration of that form of labyrinthitis concerning which the widest differences of opinion existed, namely diffuse labyrinthitis occurring during the course of an acute otitis media

In that exciting era prior to chemotherapy and penicillin therapy, Voss,[2] Scheibe,[3] Alexander,[4] Phillips,[5] Page,[6] Milligan,[7] Smith,[8] Perkins,[9] Cunning,[10] Ramadier[11] and many others advocated conservatism in the care of labyrinthitis occurring with or shortly after acute otitis media Scheibe even urged immobilizing the head and body with starch bandages On the other hand, an equally large group of competent observers, including Hinsberg,[12] Neuman,[13] Bárány,[14] Leidler[15] and others, advocated an extremely radical course In discussing the indications for labyrinthectomy in cases of acute laby-

---

[*] Read at the meeting of the Eastern Section American Laryngological Rhinological and Otological Society Inc Boston Mass Jan 7 1949

[†] From the Otolaryngological Service of Dr R Kramer the Mt Sinai Hospital New York N Y

Editor's Note This ms received in Laryngoscope Office and accepted for publication Jan 19 1949

rinth destruction occurring during the course of an acute otitis media, Lund[10] stated that there was no doubt that satisfactory results were obtained neither by the radical surgical therapy nor by conservative measures

If one draws any conclusions at all from these divergent views, it must appear that cases of acute diffuse labyrinthitis presenting primarily identical symptomatology differ in the widest possible degree in their tendency to become limited and localized and to heal, and not to extend to the intracranial contents If this is true, and I do believe it is, it follows that each case of acute diffuse labyrinthitis must be considered individually as to therapy If this were not true, these differences of opinion on the part of competent observers would be utterly unintelligible

Acute diffuse manifest labyrinthitis has been customarily divided into two groups *1* serous and *2* suppurative, a grouping which has resulted from an attempt to classify clinically identical phenomena on the basis of pathologic evidence Otologists often have fallen far short of the actual differentiation between these two states because the clinical criteria advanced have been inadequate to establish accurately such differentiation The inability to differentiate between serous and suppurative labyrinthitis is not necessarily serious, providing that as a result of careful clinical observation and experience, one substitutes for it knowledge as to which form of labyrinthitis is grave

In this communication, I propose to discuss briefly the acute diffuse labyrinthitis which occurs with or shortly after acute otitis media and to present in some detail a report of two recently treated cases Some of our previously held concepts in the handling of this serious otitic complication may require re-evaluation, in the light of the known advantageous effect resulting from the early use of chemotherapy and penicillin therapy in adequate dosage

Case 1 (No 560555) An adult male aged 26 years, was admitted to the Mt Sinai Hospital Feb 11 1947, acutely ill with temperature 105°, headache dizziness and vomiting In 1936, he was found to have moderately advanced tuberculosis One year later, he was again hospitalized at the Medical Center, New York, where after careful and thorough study the diagnosis of periarteritis nodosa was made In 1938 and 1940 he was again readmitted and the diagnosis was confirmed clinically and by biopsy Except for occasional mild upper respiratory infections the patient remained in good health until three days before his present admission, when he caught 'cold"

Because of his past medical history and because he had been advised to care for even the most insignificant infection, the patient remained at home The next morning he had pain in the left ear which persisted throughout the day and in the evening there was a spontaneous sanguino purulent discharge from the left middle ear He was promptly placed on sulfadiazine therapy by his family physician The patient was quite sick the temperature was 103° and there was restlessness irritability and nausea Forty-eight hours after the onset of the acute otitis the patient was given penicillin in addition to his sulfadiazine medication and at this time I was asked to see him

Examination revealed an acutely ill male nauseated vomiting and com plaining of severe generalized headache Motion of the head aggravated the symptoms The patient was easily aroused and quite cooperative An inexhaustible spontaneous nystagmus directed horizontally to the right was noted With the Bárány noise apparatus in the right ear there was *no hearing demonstrable in the left ear* There was some stiffness of the neck, but no other frank meningeal signs A few asthmatic wheezes in both sides of the chest and definite evidence of an acute pansinusitis were found

The left external auditory canal was filled with pus which reappeared promptly after wiping it away There was no sagging of the bony canal wall, no mastoid tenderness and all the normal drum landmarks were absent The right drum was slightly full posteriorly the landmarks though indistinct, were discernible

Laboratory Findings Hemoglobin content 12 4 gms white blood cell count 15 850 with 86 per cent polymorphonuclear cells and 14 per cent lymphocytes Serology and repeated urinalysis were negative Culture of the discharge was reported staphylococcus albus B Blood pressure determinations throughout the patient s stay in the hospital revealed a hypertension fluctuating between 194/120 to 160/112 Roentgenograms showed extensive pneumatization of both sides On the right side there was diffuse haziness particularly in the periantral region and over the knee of the sinus The right lateral sinus was more prominent than the lateral sinus on the left There was no definite evidence of destruction

Course The patient was put on what was regarded by some as unnec essarily large doses of crystalline penicillin 500 000 units intramuscularly q 3 h and also given sulfadiazine (1 gr per pound) intravenously The penicillin therapy was maintained for two weeks at the end of which time the patient still had some objective vertigo but no longer had any nystagmus At this time unmistakable return of hearing was apparent in the previously completely deafened right ear The patient was eating and sleeping well and no longer had headaches On March 3 1947 there was noted further progressive improvement in hearing On March 9 23 days after admission all medication was discontinued improvement continued and on the thirtieth day after admission the patient was discharged

Follow Up This patient has remained well the hearing is now excel lent has normal cochlear and vestibular responses

Comment I believe we are dealing with an acute suppurative otitis media with extension of the inflammatory process to the labyrinth via the oval or round window In the absence of any clinical evidence of mastoiditis and in the absence of convincing evidence of meningeal involvement, there seemed to me to be little justification for surgery The indication for the use of massive doses of penicillin and sulfadiazine appeared logical in view of the potential serious intracranial complications Since one cannot definitely distinguish between a diffuse serous or suppurative labyrinthitis on the basis of the functional tests, the assumption must be made, in retrospect, that we were dealing with a diffuse serous labyrinthitis because of the return of function Whether the early employment of massive doses of sulfadiazine and penicillin can overwhelm and sterilize an early suppurative invasion of the labyrinth and result in a cure, with return of function, is conjectural and intriguing The reports of the experience of others may throw some light on this possibility

Case 2 (No 585393) Patient, F V, aged 10 years was admitted Aug 7, 1948, to the Ear Service (Mt Sinai Hospital New York) with a history of a discharging ear and high fever of three days' duration Of significance in the past history was the occurrence of mumps at three years of age and 20 per cent loss of hearing in the right ear (nerve type) noted when tested audiometrically in the public school system The patient was swimming one week before admission He was perfectly well until three days prior to admission, when he complained of pain in the right ear and had a temperature of 103° The following day there was a scant spontaneous discharge from the right ear, some slight nausea but no vomiting The patient was brought to the emergency room given sulfadiazine therapy and sent home with instructions to return for further observation

The following day when seen he was quite sick and was promptly admitted to the Ear Service He was drowsy, complained of severe frontal headache and vomited persistently While in the ward in a few hours he became rapidly worse

Examination that evening revealed a very sick child temperature 105° pulse 152, respirations 40 per minute Oculi fundi were negative, pharynx injected tonsils enlarged and inflamed the heart and lungs were negative

The left drum was normal the right drum was inflamed throughout, the short process was distinctly visible There was no mastoid tenderness no change in the bony canal wall There was a spontaneous nystagmus directed horizontally to the left inexhaustible and present even on central gaze *There was no hearing in the right ear using a Barany noise apparatus in the uninvolved left ear*

There was marked nuchal rigidity the child was drowsy and somewhat irrational Lumbar puncture which was promptly performed yielded cloudy fluid under increased pressure and contained 6 000 cells mainly polymorphonuclear leucocytes with Gram positive organisms on smear Crystalline penicillin 10 000 units was instilled intrathecally before the cell count and smear were reported and without awaiting the report of the penicillin sensitivity test

Laboratory Data Culture of the spinal fluid revealed a pneumococcus type XII The pneumococcus type XII was found to be susceptible to 0 02 units of penicillin (less as resistant as standard) Blood culture blood Wassermann reaction and repeated urinalysis Roentgenograms of the chest and mastoid were entirely negative Hemoglobin determination revealed 12 5 gm. white blood count 23 650 with 80 per cent staph cells 9 per cent segmented polymorphonuclear leucocytes 7 per cent lymphocytes and 3 per cent monocytes

Course The patient was given large doses of sulfadiazine intravenously and 50 000 units of crystalline pencillin intramuscularly every three hours After 24 hours the temperature subsided to 102° there was abatement of the marked hyperexcitability the photophobia however persisted The Kernig and Brudzinsky signs were still present At this stage it was obviously vitally important to ascertain whether there was vestibular function present. Caloric test was performed using hot 1 5 000 bichloride of mercury solution There was a prompt response noted for nystagmus to the involved side and influencing the pre-existing spontaneous nystagmus directed horizontally to the left.

It was therefore assumed that we were dealing with a labyrinth that was still functioning It was further assumed at that time that there may have been a dichotomous spread of the infection *1* from the middle ear to the meninges either through vascular channels or dehiscences and 2 from the middle ear via the oval or round window to the labyrinth This type of dichotomous extension has been heretofore described by Dean and Wolfe[7] and others It seemed unlikely that a meningitis with 6 000 cells mainly polymorphonuclear leucocytes with pneumococci on smear and culture was apt to result as a direct extension from a labyrinth which still retained caloric irritability

Since there were neither clinical nor Roentgenographic signs of mastoiditis and since there was some evidence which seemed to point to a diffuse serous rather than a diffuse suppurative labyrinthitis it was felt that there was no indication to surgically attack the labyrinth or mastoid bone Intensive medication consisting of sulfadiazine and penicillin was continued for three weeks The meningeal signs rapidly subsided A second lumbar puncture at the end of one week of therapy revealed 30 lymphocytes and no organisms were noted on smear or culture Because of the marked improvement clinically and in the spinal fluid findings further intrathecal use of penicillin was not deemed necessary At this time the patient was symptom free there was only an occasional mastoid jerk visible on extreme lateral gaze The sulfadiazine was discontinued and the dosage of penicillin was gradually lessened and finally stopped Five weeks after admission the patient was up and about asymptomatic eating sleeping well however it was evident that there was *no hearing* present in the right ear and repeated caloric tests revealed a calorically unirritable labyrinth

Comment Whether the fact that the offending organism was a type XII pneumococus played any rôle in the resultant total loss of function, I do not know It is important to identify the infecting organism promptly in every instance to determine its relative sensitivity to penicillin that adequate dosage may be estimated and given Complications following recovery from pneumococcal meningitis have not been adequately described according to Waring and Weinstein,[18] who state that permanent neurologic damage in young children is common and often severe In 433 cases, Waring and Weinstein found the pneumococcus type XII in six cases Another point of interest stressed by these observers was that relapse was an event which occurred quite regularly with the sulfonamide treatment of meningitis, due to pneumococcus, and it occurred soon after therapy was discontinued or dosage diminished This patient at one stage of his infection had a total loss of hearing but still maintained caloric irritability Despite cure of his bacterial meningitis, the vestibular function ultimately was completely lost

Grove and Strauss,[19] in 1941, reported a case of diffuse labyrinthitis and meningitis following acute middle ear suppuration, treated by radical mastoidectomy and massive dosage of sulfonamides The patient recovered, with a partly functioning labyrinth Unterberger,[20] in 1941, reported a similar case, which, according to the prechemotherapy-day attitude towards treatment, would likely have been subjected to labyrinthectomy The patient, however, was treated with massive doses of chemotherapy and recovered with partial restoration of labyrinthine function Case 1 herein reported is an instance of diffuse labyrinthitis, in a patient with known healed periarteritis nodosa, who recovered completely with normal vestibular and cochlear function

Siirala[21], from Helsinki, in 1946, reported four cases of labyrinthogenic meningitis treated with sulfonamide therapy In three of the four cases reported, the onset was initiated by an acute otitis media In each of these three cases, the meningitis appeared simultaneously with the symptoms of involvement of the labyrinth, which was involved totally All four cases reported and treated by Sirala ultimately eventuated in dead labyrinths I believe it worth noting that in none of these cases was sulfonamide therapy started at the very onset of the acute infection in adequately large doses, nor do I believe that Case 2, reported by me, received adequate therapy early enough Sulfadiazine and penicillin therapy in this type of case, to be successful and hold some hope for complete recovery with a functioning labyrinth, must be given very early and in very large doses Since there are so few cases, and since the experiences of others is not readily available for study in numbers sufficient to draw conclusions, I have arbitrarily given one-half million units of crystalline penicillin intramuscularly every three hours with the full realization that this might be far in excess of what might ultimately prove to be necessary

It is perhaps unfortunate that we have become accustomed to figuring dosages of penicillin in thousands and hundreds of thousands of units There would, I am sure, be considerably less reluctance to the employment of peninicillin in cubic centimeter doses than there often seems to be when doses of one-half million units are suggested Some of the factors that must be considered in promptly deciding dosage, in my opinion, in order of their importance are *1* the duration of the labyrinthine infection, *2* the identity of the offending organism, *3* the susceptibility of the infecting organism to the antibiotic employed, *4* the accessibility and extent of the infection, and *5* whether there is meningitis Initial doses of one-half million units are suggested while awaiting laboratory data

Whether the treatment of labyrinthitis and meningitis following an acute otitis media results in a cure of the meningitis, as in Case 2, and leaves the patient with a nonfunctioning labyrinth, one must speculate whether earlier and more intensive treatment might have resulted in cure of the meningitis with a viable labyrinth The healing or reparative processes in a labyrinth frequently results in a loss of function (total or partial) in contrast to the healing of infections elsewhere in the body, *i e*, peritoneum, orbital cellulitis, etc, where functional impairment is negligible or unimportant It is, therefore, particularly important in the care of acute labyrinthitis following acute otitis media that the optimal dosage of penicillin and sulfadiazine be quickly determined and given Time is most important at the onset of the disease, and I suspect largely determines ultimate residual function Finally, in the cases which recover, but have *no* labyrinthine function, one must consider the possibility of a latent suppurative focus having been established in the labyrinth with its inherent danger of late intracranial complication It behooves one to observe such patients for long intervals before this potential menace can be discounted

Conclusions In this era, with its sharply curtailed incidence of suppurative disease of the mastoid and temporal bone, otologists still occasionally are confronted with cases of acute labyrinthitis and meningitis, or acute labyrinthitis with meningeal irritation occurring early after or together with the onset of an acute otitis media

In the prechemotherapy days, the prognosis in these cases, whether they were treated by conservative or radical surgical measures, was not very encouraging With the addition of sulfadiazine and penicillin to our armamentarium or therapy, the outlook for preservation of life is no longer the grave concern of former years I submit that the objective of the otologist should now be preservation of life and preservation of function as well, and this objective seems possible of attainment by the early use of sulfadiazine and penicillin in adequate dosage

REFERENCES

1 Friesner, I and Rosenwasser H Treatment of Labyrinthitis *Arch Otolaryngol*, 20 139 151 Aug 1934

2 Voss O Klinische Beobachtunguber nichteitrig Labyrinthentzundung im Verlauf Akuter und Chronischer Mittelohreiterung *Verhandl d deutsche Otol Gesell*, 18 145, 1908

3 Scheibe, A Durchbruch in Das Labyrinth, insbesondere bei der akuten form der Mittelohreiterung *Verhandl d deutsche Otol Gesell*, 7 123 1898

4 Alexander G Zur Behandlung und operativen Indikation stellung der eitrigentzundlichen Innerohrerkrankungen *Monatsschr f Ohrenhil*, 61 898, Aug, 1927

5 Phillips, W C Clinical Types of Labyrinthitis with Comments on Treatment. *Jour A M A.*, 68 336, Feb 3 1917

6 Page J R Indications and Contraindications for Operating Upon the Labyrinth *South Med Jour*, 24 31, Jan 1931

7 Milligan W Surgical Treatment of the Suppurative and Certain Nonsuppurative Affections of the Labyrinth *Jour Laryngol and Otol* 39 245, 1924

8 Smith J M Labyrinthine Surgery *N Y Med Jour* 116 85, July 11, 1922

9 Perkins, C W Indications and Contraindications for Operating Upon the Labyrinth The Laryngoscope 26 1012, July, 1916

10 Cunning, D S Some Clinical Observations on Labyrinthitis The Laryngoscope, 43 383, May, 1933

11 Ramadier, J Indications Therapeutiques dans les labyrinthites infectieuse Otogenes *Ann d oto-laryngol*, Supp 9 p 56 1929

12 Hinsberg, V Die tympanogene Labyrinthentzundung in Denker and Kahler Handbuch der Hals Nasen u Ohrenheil Berlin J Springer 1926, p 439

13 Neumann H Operative Labyrinthschadigung Befund nach 20 Jahren *Monatsschr f Ohrenheil* 60 574 1926

14 Barany R Die Indikationen zur Labyrinthoperation *Acta oto-laryngol*, 6 260, 1924

15 Leidler R The Indications for Opening the Labyrinth *Jour Laryngol and Otol*, 41 641 Oct 1926

16 Lund, R The Indications for the Labyrinth Operation with Special Reference to Acute Diffuse Destructive Labyrinthitis *Jour Laryngol and Otol*, 512 425-453 July 1936

17 Dean, L W, and Wolf D Pathology and Routes of Infection in Labyrinthitis Secondary to Middle Ear Otitis *Trans Amer Otol Soc*, 24 168-186, 1934

18 Waring, G W, Jr., and Weinstein L Treatment of Pneumococcal Meningitis *Amer Jour Med* 5 402-418 Sept, 1948

19 Grove, W E, and Strauss G D A Case of Labyrinthitis and Meningitis with Recovery *Amer Otol, Rhinol and Laryngol*, 50 288 1941.

20 Unterberger, S Uber Fortschritte in der Meningitise behandlung mit den sulfonamide praparaten unter besondere Berucksichtigung der otogene Meningitis *Arch Ohren Nasen, u Kehlkopf* 149 81 112 1941

21 Sibula, V On the Treatment of Purulent Otitis Interna with Sulfonamides *Acta Otolaryngol* 34 200 216, 1946

VESTIBULAR EXPERIENCES *

ISAAC H JONES, M D ,
Los Angeles, Calif

To give experiences one must, unfortunately, be entirely personal The experience of another would require another article—by him

With me, in studying the internal ear vestibular studies are routine, especially the turning tests

These comments will be limited to *1* office routine, *2* neuroma of the VIII Nerve, and *3* vestibular lesion in the brainstem, from streptomycin poisoning

Recently, two medicolegal cases were studied at the same time Each had been studied by leading otolaryngologists whom we know and respect — but without vestibular tests In each, vestibular studies completely reversed the diagnosis One man, very deaf, had been exposed to loud noise for a long period The opinions of two otolaryngologists in New York and three in Los Angeles were unanimous — that his cochleae had been damaged by the noise The first thing to do, of course, was to turn him After turning there was no nystagmus whatever — not even a quiver of the eyes, so, in less than a minute, it was clear that he suffered from syphilis or some other constitutional disease Noise, no matter how loud, obviously could not destroy vestibular function After turning in either direction there was no nystagmus and no sensation of motion, and the caloric tests — douching each ear for four minutes with water, temperature 68° — showed a total absence of any responses whatever, there was no nystagmus, motion-sensing, past-pointing, falling or constitutional response. It was also clear that this defect had been coming on for a very long time, because he had never had vertigo or any other vestibular symptom. On receipt of this report the legal decision was reversed and the claim disallowed.

---

*Read at the meeting of the Western Section American Laryngological Rhinological and Otological Society Inc Los Angeles Calif Jan 30 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication March 1 1949

Experiences like this make me realize that, without the vestibular tests, I would come to exactly the same wrong conclusions as my otherwise more intelligent colleagues.

The other man had been examined by four otolaryngologists and the only reason I had the privilege of seeing him was that each of the reports showed such different degrees of deafness that the request was "to try to determine how deaf he is." He wasn't deaf at all. The hearing was good in each ear. The reason for his apparent deafness and also for the variability shown in his many hearing tests was that his *attention* varied. The injury produced psychic trauma — not acoustic trauma. When the caloric tests were made the following occurred. While the right ear was being douched (completely masking out hearing from this ear) he responded to all questions spoken in a soft voice. When he began to feel "dizzy" we said in a quiet and kindly voice, "Does the water make your ear feel too cool? Do you feel that things are turning around?" His perfectly natural responses demonstrated that he had excellent hearing in this "deaf" ear. Similarly, while the left ear was being douched he responded to questions promptly and accurately. Above my desk hangs a wood-duck. While my back was turned to the patient he asked, "Isn't that a wood-duck?" Without turning my head I said softly, "Yes, what do you know about wood-ducks?" Deeply interested, he related that on one occasion he had shot down 11 and that he was much upset when he found out the law did not permit more than one wood-duck to be killed by any one person in one year. Again we realized that his hearing was very good indeed, but later, while he was sitting in a corner for the obvious purpose of having his hearing tested, I approached him from a 20-foot distance. He did not answer questions when my voice was loud even at a distance of four feet Obviously his hearing trouble was due to inattention He could not concentrate on the matter at hand Evidently the blast of air to which he had been subjected had touched off this set of mental reactions There was no thought of malingering The man showed every willingness to cooperate to the fullest extent He repeatedly said, "All I know is that I was able to do good work before this thing happened and now I am no longer able to do such work" He was not only sincere but naive In this case we were put on the right track because the peculiar sensations from the turning, and especially from the douching, took his mind off his troubles—then he heard well Our suggestion to the court was to have the proper person explain to him the real nature of his trouble We felt that if this could be done he would not only have satisfactory hearing but should come to realize that he does have good hearing

We vary as to our ideas of what is essential—which is natural I, for one, would not know what to do without the routine vestibular tests in any problem that concerns the internal ear If the ophthalmologist used the ophthalmoscope and took the fields of vision—and yet studied only one-half of the retina—we would not only be critical of his technic but would realize that he might be missing the main lesion If I were considering having a fenestration operation on myself, I would want the fullest information as to the precise condition of my internal ear Why limit the study to the cochlea? Why not find out all we can, instead of being satisfied with "just enough"? One might say, "I have never had a turning chair and yet I get along all right" I couldn't Some feel that the caloric test is all-sufficient Not for me Often the turning shows responses very different from the caloric, we do not know why, although we suspect it is because turning produces a more intense and less prolonged stimulus

All of us have babies brought to us who appear to be deaf We turn the mother with the child in her lap The mother holds the child with the head forward toward her knees, with her hands over the baby's eyes At the end of the turning the mother keeps her eyes shut, but lifts the child If there is no tendency for the child to fall the evidence is strong that both internal ears are markedly involved

In court we have frequently demonstrated that a lesion of the internal ear was recent When the facts are explained to the jury, they are always accepted at face value Recently a woman showed a lesion of the left internal ear We explained that it was recent — because turning to the right showed almost no responses, whereas turning to the left showed excellent responses We explained that after a few months, although the lesion might remain the same, the responses would have become equalized She would then show the same response after turning in either direction

What do we mean by vestibular tests? We certainly do not mean some of the tests that are now used, such as using a certain amount of water or just one squirt of ice water Surely such tests are trivial The neurologist does not limit himself to the cremasteric reflex and then say, "I have made a complete neurologic examination " For 34 years we have used the same turning and caloric tests Although the newer tests are more popular and seem an easy way out, yet there are no short cuts to good work and a complete study Our technique has always been as follows *Spontaneous* Nystagmus and pointing *Turning* The duration and amplitude of nystagmus, the number of seconds of motion-sensing, constitutional responses *Caloric* Water, 68°, how long it takes the douching to produce the nystagmus, pointing tests, head back (testing horizontal canal), note nystagmus and take past-pointing, falling test, then head back again, noting duration of nystagmus, note constitutional responses

TUMOR OF THE VIII NERVE

It is not generally known that one-tenth of all brain tumors grow on the VIII Nerve If a patient is very deaf in one ear, the first thought should be of a possible tumor In some the first symptoms are auditory — hearing defect and tinnitus, in others, although less often, the first symptoms are vestibular

The phenomenon-complex which we brought out in 1915 has been confirmed by our experiences since *1* On the side of the tumor a loss of auditory and vestibular function *2* On the opposite side normal auditory function, normal responses from the horizontal canal, but absence of responses from the vertical canals The usual sequence During the early period of the development of the tumor a gradual or sudden loss of auditory and vestibular functions In the course of weeks or months one or more of the following findings may appear *1* The impairment and later loss of responses from the vertical canals of the opposite side *2* Spontaneous vertical nystagmus upwards may be observed *3* In some cases the horizontal canal of the opposite side produces normal nystagmus, but later produces a perverted nystagmus

VESTIBULAR DAMAGE FROM STREPTOMYCIN

A more recent experience concerns streptomycin poisoning When this remarkable new drug appeared it was quickly evident that even this rose had its thorn Its effect on tuberculous and other lesions seemed almost miraculous, but soon many patients were stricken with disturbed equilibrium

From what one reads, sees and hears, the following symptoms stand out There are reports of tinnitus, and occasionally of hearing defects, although in most cases some doubt exists because of associated meningitis, syphilis or acoustic trauma from war experience Certainly there is little or no evidence of the well-known picture of end-organ lesion— vertigo, nystagmus, pallor, sweat, nausea and vomiting On the contrary these patients complain of symptoms mainly referable to the brain-stem rather than to the periphery Vertigo, by which is meant "a sensation of turning not in accord with fact," is almost never noted The patient notes "a queer feeling," which is one of instability or insecurity, when the head is moved Most of the patients lying quietly in bed and not moving the head have no sensation of movement, it is only on changing position, such as in attempting to get out of bed, that they feel uncertain and go too far in the attempted movement They tend to fall, but in no special direction They "over-fall" in the direction in which they start to move As one expressed it, "The brakes don't work" If the patient is reading with head quiet on the pillow, the print does not seem to move, it is only when the head is raised that the print appears blurred On attempting to walk, these patients stagger They are unable to walk in a dim light or on an inclined surface and tend to fall on turning quickly Often they do not fall, but fear they will Later, while riding in an automobile over rough ground, the patient notices that the scenery seems unsteady, but this ceases when the road becomes smooth

Two years ago the Veterans Administration was startled by the large number that developed ataxia and yet maintained good hearing I was asked by Dr John S Chase, "Where's the lesion?" Without hesitation, I reported, "In the Central Vestibular Tract in the brain-stem" Why such a positive statement? Because of one classic experience

Dr William G Spiller, than who there has never been a greater neuro-anatomist, has given the last word on this subject—in a report by Jones and Spiller* before the American Neurological Society As these findings are not available in otologic literature they are here included in condensed form This demonstration of the Central Vestibular Tract, first made evident by this study, was made possible by a sequence of events that may never happen again

The case of encephalitis presented the following features An absence of vestibular function, with no impairment of auditory function All examinations and tests were made just before death, which occurred only 11 days later The autopsy revealed nothing abnormal — indicating that there were no pressure phenomena and that the lesion was microscopic Dr Spiller made over 1,000 serial sections of the brain-stem and for the first time revealed the Central Vestibular pathways

Before this Central Vestibular Tract was discovered, the auditory fibers had been demonstrated in the brain-stem, and also the two sets of vestibular nuclei (Deiters, von Bechterew and Triangularis), which receive the fibers from the vestibular portion of each VIII Nerve There had been no definite evidence, however, to show where the fibers continued from these nuclei in the medulla

---

*Isaac H Jones M D and Wm. G Spiller M.D The Central Tracts of the Nervus Vestibularis Brain Sept. 1925

In attempting to discover these pathways, those who have undertaken work on animals have encountered two main difficulties *1* Secondary degeneration is interrupted at the next synapse *2* There is the obvious difficulty in producing minute lesions in certain portions of the brain-stem without damaging other structures, both distant and adjacent Throughout these various segments it would be necessary to produce lesions which would involve each neuronal segment in turn These difficulties appear almost insuperable

On the contrary, certain pathologic processes occasionally result in small discrete lesions within the central nervous system, which cannot be duplicated by operative work on animals Such lesions may be produced by thrombosis, multiple sclerosis, or small foci of encephalitis The proven case reported by Jones and Spiller was of this nature, presenting minute lesions due to encephalitis

Clinically this boy, age 15, presented a strange picture He had always been full of energy and a leader in school athletics — particularly in gymnastic work He could walk on his hands almost as well as on his feet and excelled in basketball, baseball, football and tumbling He had a good record in his scholastic studies and was in his second year at high school

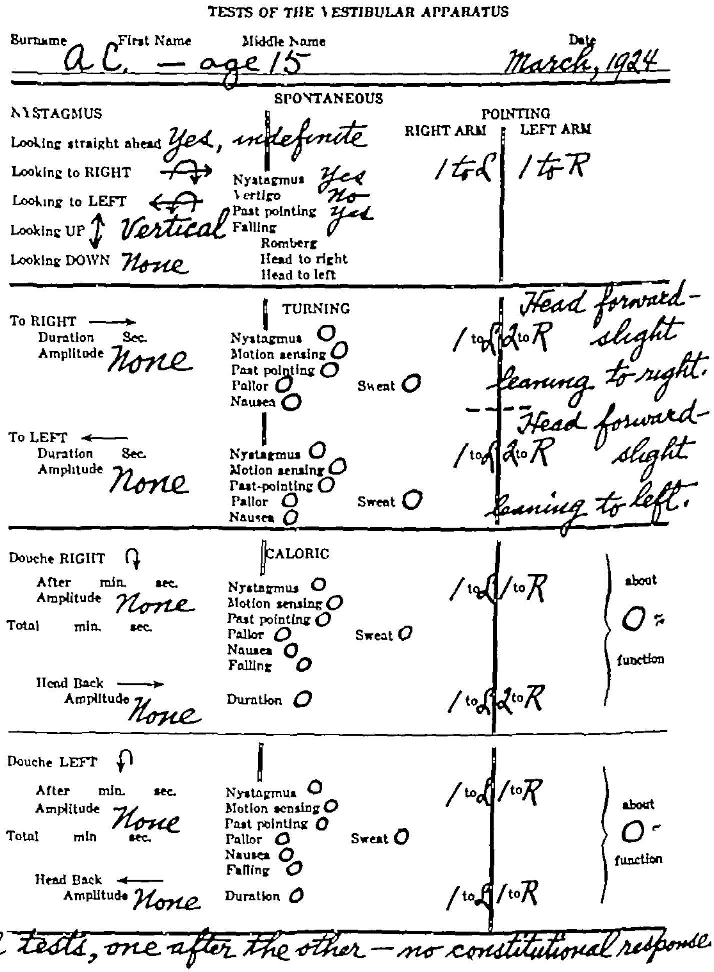
Following an acute attack of influenza he complained of fatigue and of being "short of wind" On getting up from a sitting position he was unable to move about without holding on to something to steady himself The first symptoms noted were incoordination, disturbance of equilibrium and gasping for breath He had some difficulty in swallowing, no pain *Neurologic examination by Dr Samuel D Ingham* Patient was well developed and fairly well nourished Taste and smell normal Romberg negative Attempts to cough were ineffectual Impaired upward movements of the eyes and almost no convergence Pupils equal and reacted to light No loss of voluntary movements of the muscles of mastication or of the face, tongue or palate, no wasting or tremors Tendon reflexes present in all extremities, slightly excessive but equal on both sides *Mental condition* Bright and alert and of more than average intelligence, in complete possession of all his mental faculties No emotional or psychoneurotic symptoms

Eye examination by Dr Theodore C Lyster Vision good for distance, near vision, accommodative power and convergence were poor Eye movements slightly limited in all directions, especially upward, when the eyes began to sag downward and at the same time showed an undulating movement up and down Disc margins fairly well defined Maculae clear, blind spots normal Under homatropine dilatation there was found an error of hypermetropic astigmatism, vision improved to full normal in each eye when corrected

Ear, nose and throat examination by Dr Eugene R Lewis and Dr Isaac H Jones Chronic purulent tonsillitis, chronic pharyngitis, cervical adenitis in the anterior chain — each side, otherwise negative

Prof Vern O Knudsen and Dr Jones found the audiograms to be normal, including the upper limits Tests with the amplified voice and amplified whisper showed perfect hearing No diplacusis or tonal islands No tinnitus had ever been noted It was evident that both cochleae and the auditory neural pathways had perfect function

Vestibular report (see Fig 1) On looking straight ahead, a spontaneous nystagmus of indefinite character, the eyes were constantly moving but the amplitude was small The lower and upper eyelids also moved synchronously with the movement of the eyeballs On looking upward, a vertical nystagmus — but the quick movement was not definite or rhythmic After turning to right, no nystagmus — other than the already existing spontaneous nystagmus No past-pointing Turning to the left similarly failed to produce any nystagmus or past-pointing Turning to the right with the head forward caused the patient to lean slightly to the right when he sat up, while turning to the left with the head forward caused him to lean slightly to the left *Caloric tests* Irrigation of the right ear, water 68°, for four minutes No response in nystagmus or past-pointing Upon tilting his head backward (testing the horizontal canal) there was also no nystagmus or past-pointing No falling response On douching the left ear the findings were identical — *i e*, no vestibular responses All the turning and caloric tests were conducted one after the



TESTS OF THE VESTIBULAR APPARATUS

Surname First Name Middle Name Date
A. C. — age 15 March, 1924

SPONTANEOUS

NYSTAGMUS
Looking straight ahead Yes, indefinite
Looking to RIGHT
Looking to LEFT
Looking UP ↕ Vertical
Looking DOWN None

Nystagmus Yes
Vertigo No
Past pointing Yes
Falling
Romberg
Head to right
Head to left

POINTING
RIGHT ARM 1 to L
LEFT ARM 1 to R

TURNING

To RIGHT →
Duration Sec.
Amplitude None
Nystagmus 0
Motion sensing 0
Past pointing 0
Pallor 0
Nausea 0
Sweat 0
1 to L 1 to R Head forward—slight leaning to right.

To LEFT ←
Duration Sec.
Amplitude None
Nystagmus 0
Motion sensing 0
Past-pointing 0
Pallor 0
Nausea 0
Sweat 0
1 to L 1 to R Head forward—slight leaning to left.

CALORIC

Douche RIGHT
After min. sec.
Amplitude None
Total min. sec.
Nystagmus 0
Motion sensing 0
Past pointing 0
Pallor 0
Nausea 0
Falling 0
Sweat 0
1 to L 1 to R
about 0 % function
Head Back →
Amplitude None
Duration 0
1 to L 1 to R

Douche LEFT
After min. sec.
Amplitude None
Total min sec.
Nystagmus 0
Motion sensing 0
Past pointing 0
Pallor 0
Nausea 0
Falling 0
Sweat 0
1 to L 1 to R
about 0 % function
Head Back ←
Amplitude None
Duration 0
1 to L 1 to R

all tests, one after the other — no constitutional response

Fig 1 Encephalitis localized

other and yet there was an utter absence of pallor, sweat or nausea

There was, therefore, a complete vestibular block, the location of which appeared to be within the brain-stem In brief, he had perfect auditory function and no vestibular function

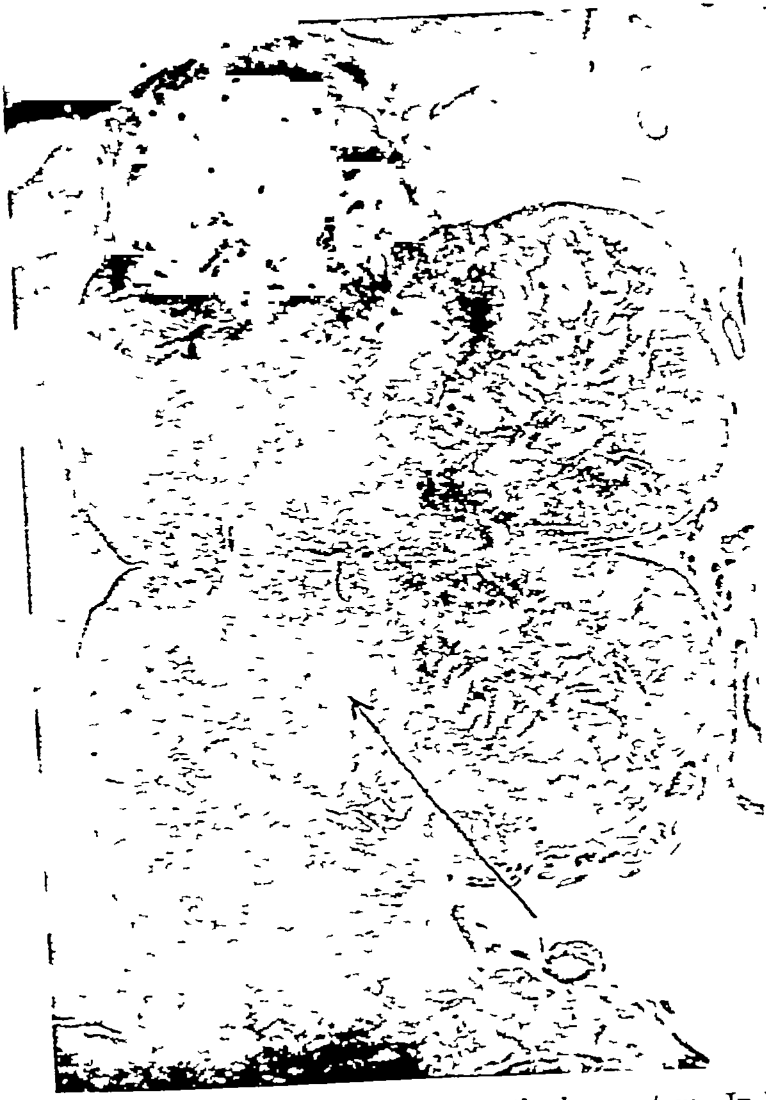


Fig 3 (Section 9) Separate areas of degeneration on each side of the raphe (From Jones and Spiller, Brain, Sept 1926)

Eleven days later he died Respiration became rapid, shallow and irregular Intellect remained keen He suddenly became comatose and cyanosed, and died of respiratory failure The pulse had been of comparatively good quality

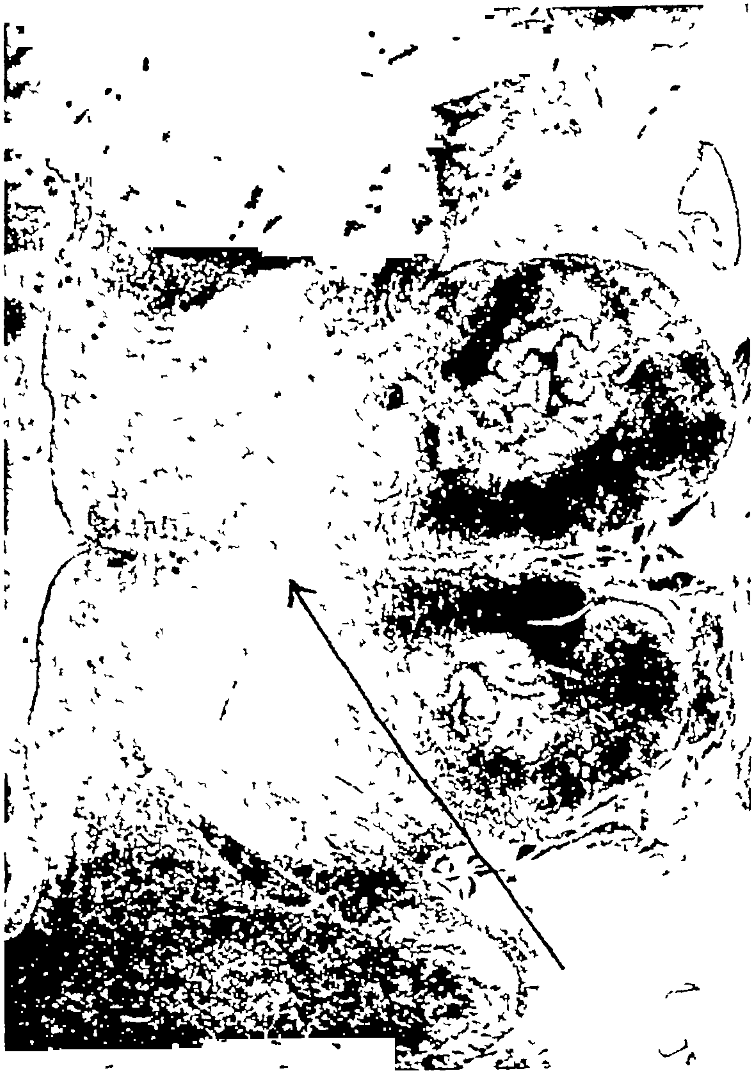


Fig 3 (Section 33) The degeneration on each side of the raphé has united and implicated the raphé (From Jones and Spiller Brain Sept 1921)

Autopsy negative in all details The whole brain was removed and sent to Dr William G Spiller, who made the exhaustive study For our purposes the following gives the essence of his findings

* * * * *

VIII NERVE

The system of the VIII Nerve is one of the most complex and difficult to determine in the entire nervous system The

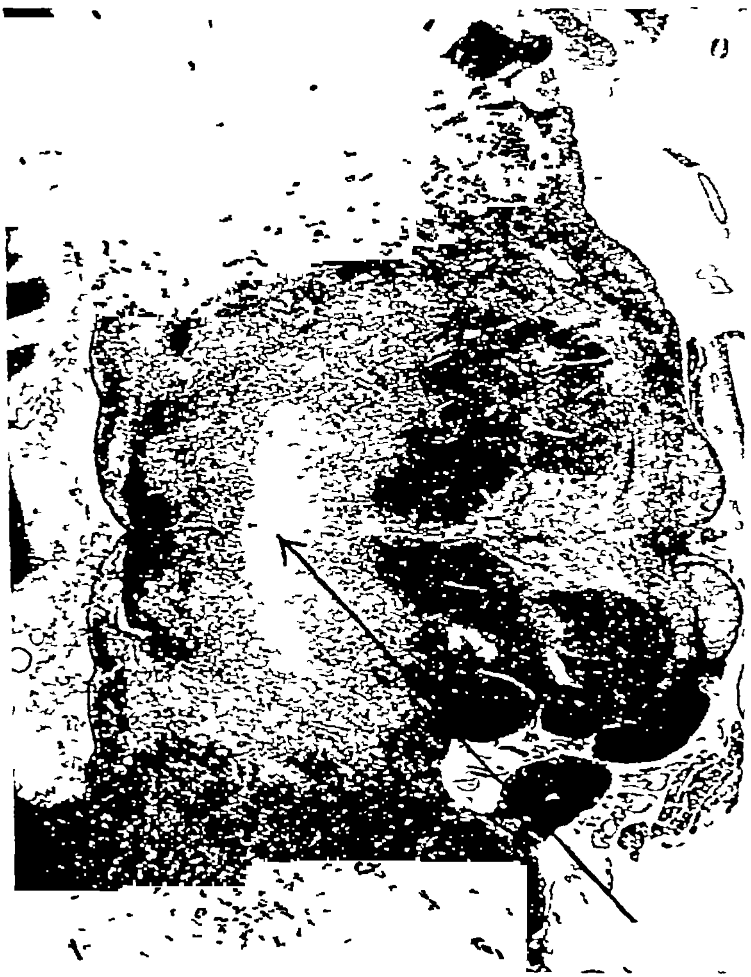


Fig 1 (Section 70) The degenerated area destroys all fibers at the center of the raphe
(From Jones and Spiller Brain Sept 1925)

fibers of the VIII Nerve itself are well understood and also the pathways from the cochlea in the brain-stem However, knowledge of the vestibular pathways in the brain-stem had been obscure up to the time of this study

The brain-stem from the lower portion of the medulla oblongata to the end of the aqueduct of Sylvius was cut in microscopic serial sections, over 1,000 in number, and of these a very large number was stained, every third or fourth section at some levels, by various methods

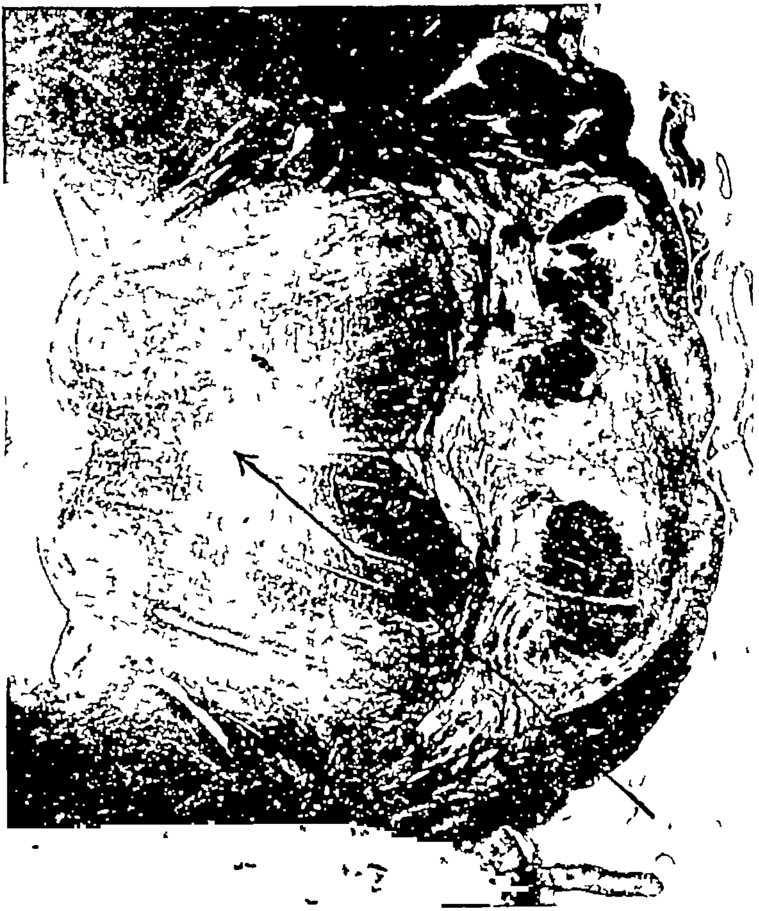


Fig 5 (Section 110) The central area of degeneration has greatly diminished in size at this level—corresponding to the nucleus of the nervus abducens on each side (From Jones and Spiller Brain Sept 1925)

The important finding was a limited area of complete degeneration in the center of the tegmentum, extending from the lower part of the medulla oblongata well up into the lower part of the pons, on each side of the raphé

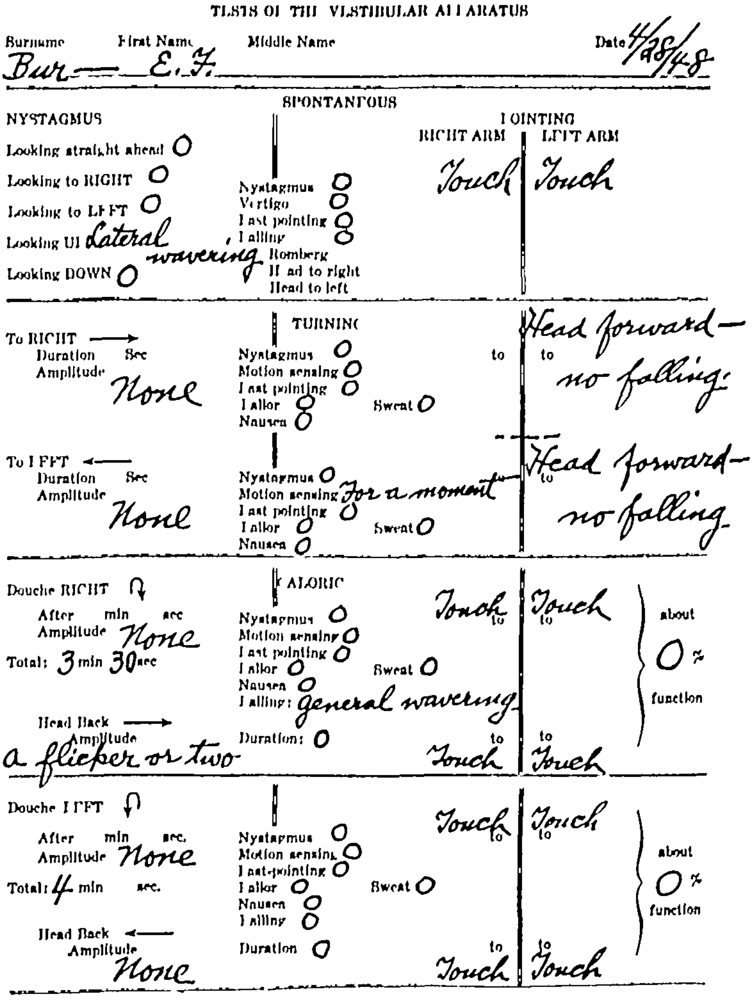
It may be concluded from this study that all or nearly all of the central tracts concerned with vestibular function pass through the area represented by this degeneration, also that few if any of the fibers of the cochlear system are represented in this region The fibers of both the vestibular and cochlear portions of the VIII Nerve escaped entirely In this case, although there was a complete vestibular block, the degeneration involved only the *central* tracts of the vestibular system

Important changes in the form and number of nerve cells were found in the primary nuclei and it was concluded that the fibers from these nuclei extended into this central area of degeneration

* * * * *

In the non-neurologic language of football, the Central Vestibular fibers (see Figs 2, 3, 4 and 5) "buck the line" outside of tackle, in the medulla, then, higher up, between tackle and guard, and higher up, through center — whereas the auditory fibers run around the ends

In streptomycin poisoning almost every symptom and every finding points to brain-stem lesion, yet in reports of these cases we find such terms as "aural disturbances," "otic complications," "labyrinthine functional upsets" and "reaction on the VIII Nerve apparatus" — all of which are not only vague but refer to the end-organ Just as mumps selects the internal ear and the testicle, so streptomycin seems to have the equally strange selective affinity for this Central Vestibular Tract The following (see Fig 6) is identical with the classic findings of Dr Spiller A man, aged 57, had received streptomycin for bacterial endocarditis Then came the familiar vestibular symptoms His cochleae were unaffected On looking up, there was a lateral wavering of the eyes Turning produced no nystagmus, no motion-sensing and no constitutional responses Even when he was turned with the head forward and then sat up there was no falling response whatever After four minutes of douching of each ear there was no response in nystagmus, motion-sensing, past-pointing or falling Auditory function, unaffected Vestibular function, nil



TESTS OF THE VESTIBULAR APPARATUS

Surname Bur— First Name E. F. Middle Name Date 4/28/48

SPONTANEOUS

NYSTAGMUS
Looking straight ahead 0
Looking to RIGHT 0
Looking to LEFT 0
Looking UP Lateral wavering
Looking DOWN 0

Nystagmus 0
Vertigo 0
Past pointing 0
Falling 0
Romberg
Head to right
Head to left

POINTING
RIGHT ARM Touch
LEFT ARM Touch

TURNING

To RIGHT →
Duration Sec
Amplitude None
Nystagmus 0
Motion sensing 0
Past pointing 0
Pallor 0
Nausea 0
Sweat 0
to
to
Head forward— no falling.

To LEFT ←
Duration Sec
Amplitude None
Nystagmus 0
Motion sensing For a moment
Past pointing 0
Pallor 0
Nausea 0
Sweat 0
to
Head forward— no falling.

CALORIC

Douche RIGHT
After min sec
Amplitude None
Total: 3 min 30 sec
Nystagmus 0
Motion sensing 0
Past pointing 0
Pallor 0
Nausea 0
Sweat 0
Falling: general wavering
Touch to
Touch to
about 0 % function
Head Back →
Amplitude a flicker or two
Duration: 0
to Touch
to Touch

Douche LEFT
After min sec.
Amplitude None
Total: 4 min sec.
Nystagmus 0
Motion sensing 0
Past-pointing 0
Pallor 0
Nausea 0
Falling 0
Sweat 0
Touch to
Touch to
about 0 % function
Head Back ←
Amplitude None
Duration 0
to Touch
to Touch

Fig 6 Streptomycin poisoning

Conclusion In streptomycin poisoning other structures may also be involved, but the essential lesion is in the Central Vestibular Tract

635 South Westlake Avenue

PARALYSIS OF THE LARYNX FOLLOWING A PROPHYLACTIC INJECTION OF TETANUS ANTITOXIN*

HENRY DINTENFASS, M.D.,
Philadelphia, Pa.

Complications following the use of serum both for prophylaxis and in the treatment of disease are more common than is generally supposed.[1] This is especially true of tetanus antitoxin. The pathologic changes occuring are usually neurologic in character and may involve nerve structures anywhere in the body. A review of the literature has disclosed that the brachial plexus,[2] the oculomotor,[3] the facial, the auditory[4] and the recurrent laryngeal nerves[5] have been most often affected either singly or in combination. Imperatori, Neffson, Floyd *et al.* and Clerf have had experiences in which the recurrent nerve alone was involved. In the case to be presented, the recurrent nerve was involved simultaneously with the brachial plexus.

M. R., a white 33-year-old male, sustained an injury to the palm of his left hand on July 1, 1948. The wound was properly cleansed and adequate antisepsis used. The next day 1,500 units of tetanus antitoxin were injected into his left arm after sensitivity tests of the skin had given negative results. In the succeeding week he complained of constant nausea with general bodily weakness especially marked in both upper extremities. There was considerable pain in the shoulders, which radiated to the back of the neck. A tender lymphatic gland had developed in the left axilla. On July 9 he received penicillin in oil, 300,000 units intramuscularly. Twenty-four hours later several large hives appeared on the left arm, and adrenalin hypodermically was administered. When he awakened on the morning of July 13 he found he was unable to talk above a whisper. The weakness of the right upper extremity had cleared but on the left side it had remained.

---

*Read before the Section on Otolaryngology of the College of Physicians, Philadelphia, Dec. 15, 1948.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 2, 1949.

I first saw the patient on July 19 He was completely aphonic and had been so for the preceding week His previous medical history was irrelevant The tonsils had already been removed The sinuses were essentially negative for any pathology The laryngoscopic examination disclosed the vocal cords to be in abduction, with loss of tension When phonation was attempted, the cords showed no tendency to come toward the midline The arytenoids were separated There was a slight, ineffective cough present significant of a lack of expulsive air power because of the failure of the glottis to close His most strenuous efforts to talk resulted in a forced whisper Recurrent nerve involvement with paralysis of the larynx was diagnosed Movements of the left shoulder at this time gave evidence of weakness He raised the left hand to the level of the head with difficulty and then could hold it in that position for only a short while There was thinning of the musculature over the left scapula

Three weks following his injury the weakness of the left shoulder had become more pronounced, and atrophy of the left scapula muscles was quite apparent The laryngeal picture remained exactly the same until Sept 19, *i e*, about nine weeks after the onset of his trouble, when beginning vocal cord movements were observed In the next few days definite adduction was noticeable and with this a slight return of the voice The tone at first was harsh, but in a period of a week improvement was so rapid that there was good phonation with very little effort At the present writing five months after his accident although the voice quality is good, there is atrophy of the muscles of the left arm and shoulder, in addition to the involvement of the scapula muscles

The causative factor of the laryngeal paralysis here was unquestionably the serum injection This is well proven by the case history, the reports in the literature and the associated paralysis of the brachial plexus The diagnosis is to be differentiated from paralysis of the vocal cords or functional origin Functional paralysis is usually brought on by a sudden shock, scare or overuse of the voice and is frequently seen in hysterical females Muscular atrophy is never present

This case reveals the possible dangers ensuing from a supposedly harmless medical procedure Fournot,[6] Gammelgaut[6] and others have reported fatalities after the administration of tetanus antitoxin given only for prophylactic purposes Regarding the pathologic processes involved, Kraus and Chaney[7] believe that a disorder of the blood vessels occurs, causing nutritive impairment of the tissues of the nervous system and interfering for a time with the activity of the nerve fibres and cells, but occasionally producing cell death and parenchymal necrosis This theory is well illustrated in our patient and explains why the laryngeal paralysis was of a temporary nature, whereas the brachial plexus involvement resulted in atrophy of the shoulder girdle muscles

BIBLIOGRAPHY

1 Doyle, J B Neurologic Complications of Serum Sickness *Amer Jour Med Sci*, 185 484, Apr, 1933

2 Lasserre and Saft Dissociated Paralysis of Brachial Plexus Following Vaccination, Case *Bull et mem Soc med et chir de Bordeaux*, pp 368-374, 1935

Shermitte, L, Cliquet and Gauthier Scapula Paralysis Following Preventive Injection of Antiserum, Case *Rev Neurol*, 63 900 904, June, 1935

Weber, G Paralysis of Brachial Plexus Following Immunization Case *Deut Med Wchnschr*, 65 604 Apr 14, 1939

Froment, J, Kohler and Bertogo, H Paralysis of Brachial Plexus Following Administration of Antitoxin with Simultaneous and Exclusive Involvement of Serratus Magnus, Infraspinatus and Middle Trapezius Muscles *Lyon Med*, 167 224 228, Mar, 22, 1942

3 Mason, V K Optic Neuritis in Serum Sickness *Jour A M A*, 78 88 Jan. 14, 1922

Valerio, A Oculomotor Paralysis After Preventive Injection of Tetanus Antitoxin *Arch A' Ophth* 49 181, Mar, 1932

Curtis, F J Ocular Palsy Following Antityphoid Tetanus Injection *Jour Royl Nav Med Serv*, 31 180 181, Mar, 1932

4 Cutter, R D Auditory Nerve Involvement After Tetanus Antitoxin *Jour A M A*, 106 1005, first reported case Mar 21, 1936

MacCready, P B Inner Ear Deafness from Antitoxin Injection *Amer Otol, Rhinol and Laryngol*, 47 247 252, Mar 1938

5 Clerf, Louis H Recurrent Paralysis of the Larynx Following Antitoxin Injection Given Pdophylactically Personal communication.

Imperatori, C J Bilateral Abductor Paralysis of Larynx Caused by Injection of Antiserum and Its Subsequent Stenosis Due to Perichondritis *Trans Amer Laryngol Assn*, 57 240 241 1935

Neffson, A. H Recurrent Paralysis of the Larynx Following Injections of Tetanus Antitoxin Report of Case *Arch Otolaryngol* 27 201 203 Feb, 1938

Floyd, H S, Pembleton, W E and Vinson P P Paralysis of Left Recurrent Laryngeal Nerve Following Antitoxin Administration *W Va Med Jour* 38 253 254 July, 1942

6 Fournot Death Due to Prophylactic Use, Case with Autopsy *Ann de med leg*, 18 667 669, Oct, 1938

Gammelgaut, A Fatal Shock Following Prophylactic Injection of Antitoxin *Acta Path et Microb Scandinav*, 19 1 42

7 Kraus, W M and Chaney, L B Serum Disease of the Nervous System, Report of Three Cases *Arch Neurol and Psych*, 37 1035, May, 1937

1305 Spruce Street

VIRUSES IN THE OROPHARYNX AND NASAL PASSAGES *

JOHN F ENDERS, Ph D † (by invitation),
Boston, Mass

It is somewhat difficult to select from the now very large body of information concerning viruses those aspects which might be of especial interest to members of this group After weighing this problem of selection, it seemed perhaps most profitable to review rapidly those viruses pathogenic for man which, during the course of the disease they incite, may be present in the mouth, pharynx and adjacent structures, then, with a general survey of this sort completed, to consider in more detail our present knowledge of a few of the virus diseases which the otolaryngologist may encounter

I have decided on this procedure not merely because I hope that the review of the factual material may be helpful, but also to call your attention to two misconceptions which, as far as I can judge, are somewhat widespread Both of them have arisen, naturally enough, from the rapid advances that have been made during the last 15 years in our knowledge of viruses Within this period a considerable number of agents of this class have been recognized as the cause of disease in man, and new techniques for the laboratory diagnosis of many viral infections have been developed Because of these advances two inferences have been drawn *1* laboratories equipped for the study of viruses are prepared to attempt

---

*Read by invitation at the meeting of the Eastern Section American Laryngological Rhinological and Otological Society Inc Boston Mass Jan 7 1949

†Chief Research Division of Infectious Diseases the Children s Medical Center Children s Hospital Boston and Associate Professor of Bacteriology and Immunology Harvard Medical School

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 21 1949

the isolation of virus or to carry out diagnostic serologic tests on any specimen which may be submitted with a request for "virus studies", *2* a tentative diagnosis of "virus infection" is appropriate in conditions which appear to be infectious but in which no etiologic agent can be identified on the basis of either clinical or laboratory data That both these inferences are unwarranted will, I trust, appear from the remarks which follow

We may turn now to a summary of those viruses which attack man and which appear in the nose, the throat or the mouth during the course of the infection In Table 1, I have attempted to list as completely as possible the infections of this sort in which there is definite evidence that the virus is present in the sites I have just mentioned This evidence consists either in the isolation of the agent from saliva, nasal discharges or nasopharyngeal washings, or in epidemiologic observations which appear to be conclusive The table also indicates whether or not practical methods are available for the isolation of the virus or its identification as the infecting agent by serologic techniques

The tabulation reveals three points of interest In the first place it shows that the number of viruses which may be found in the nose, mouth or throat is considerable Indeed, their number certainly equals if it does not exceed that of the various species of pathogenic bacteria which may invade these structures

A priori this fact suggests that the cells of the mouth and upper respiratory tract provide favorable conditions for the multiplication of many viruses In certain instances, such as herpes simplex stomatitis, herpes zoster, influenza, common colds, varicella, smallpox, measles and foot-and-mouth disease and the stomatitis and diarrhea of infants, this hypothesis is supported by the direct evidence of localized tissue injury—injury that is presumably the result of the local proliferation of the virus On the other hand, there is little doubt that in rabies and mumps all the virus present in the saliva arises either in the parotid gland or its associated nervous connec-

TABLE 1 VIRUS DISEASES IN WHICH AGENT MAY BE PRESENT IN OROPHARYNX OR NASAL PASSAGES

Tissues Most Frequently Involved			
Skin	Respiratory or Gastrointestinal Tract	CNS	Others
*Herpes simplex	*Epidemic influenza	*Rabies	*Mumps
*Smallpox	†Infantile stomatitis and diarrhea	*Lymphocytic choriomenin.	
*Foot and mouth disease	‡Common colds	*Russian Far East enceph.	
†Measles	‡Primary atypical pneumonia	*Venezuelan equine enceph	
‡German measles		*Japanese B enceph. (?)	
‡Chickenpox		†Poliomyelitis	
‡Herpes zoster			

*Methods for isolation of virus available. Diagnosis possible by tests for specific antibody
†Methods for isolation of virus complex and uncertain. No tests for specific antibody
‡No methods for isolation of virus No tests for specific antibody

tions Between these two groups in which the situation is reasonably clear lie the virus diseases of the central nervous system other than rabies which are listed in the table Here, in the absence of clearly defined pathologic changes, we are quite uncertain as to whether the agents multiply locally, or are transported to the mucous membranes via the blood, the lymph or the nervous pathways from peripheral ganglia or the central nervous system itself In the case of poliomyelitis, the virus has been isolated from the tonsil, but this does not prove that proliferation in this tissue has occurred Probably within the near future, by means of tissue culture methods which are now available, it may be directly shown whether or not the virus of poliomyelitis as well as the other neutropic agents can multiply within cells of the tonsil, as well as of other tissues derived from the oropharynx

With possibly a few doubtful exceptions the table, as I have said, defines the limits of the group of known viruses which occur in the areas under consideration Future investigations may reveal the etiologic rôle of as yet unknown filtrable agents in certain conditions whose causes are now obscure Such research may also demonstrate some hitherto unsuspected effect of the viruses that we already recognize At present, however, it would seem to be the part of wisdom and good science to preserve a rigorously critical attitude when it is vaguely proposed that a "virus" is responsible for a lesion of uncertain origin

This statement, however, does not imply that in certain diseases in which the etiology is undefined the possible participation of a virus should not be entertained Suggestions such as that made recently by H G Tobey[1] that a virus may be involved in cases of otitis media in which the effusion is bacteriologically sterile deserve to be seriously considered and followed up by experimental study Indeed, it is often the observant clinician who stimulates the laboratory worker to renewed etiologic research.

Finally, Table 1, with its footnotes, indicates those infections in which it is possible by laboratory procedures to confirm or establish the diagnosis It may be a satisfaction to investigators in the virus field that in nine of these 17 diseases such methods have been made available, nevertheless, their impracticality in the routine diagnosis of a disease as important as nonparalytic poliomyelitis as well as their complete deficiency in most of the common viral diseases of childhood must be regarded as unsatisfactory

When the laboratory diagnosis can be made, it is based either upon the isolation of the virus in a susceptible animal or upon the demonstration of the development of specific antibody during the acute phase and early convalescence Even with those viruses that are most easily propagated in the laboratory, such as influenza, mumps and herpes simplex, the procedures are time-consuming and expensive Accordingly this mode of diagnosis should be in most instances employed only under special circumstances, as in the determination of the prevailing agent in epidemics or when the clinical data strongly suggest the nature of the infection

In contrast to isolation of the virus, serologic tests provide a relatively convenient and rapid means of diagnosis, especially when the techniques of complement fixation or the inhibition of virus hemagglutination are employed If it is necessary to depend upon the demonstration of the development of virus-neutralizing or protective antibodies, the procedure requires much more time Fortunately, the complement fixation reaction has now been found to be applicable to most of the viruses which can be maintained in the laboratory, moreover, infections with the viruses of mumps and influenza can be readily distinguished not only by the complement fiaxation test but also by the red cell inhibition reaction which I have mentioned In all serologic tests it is necessary for a final diagnosis to obtain two specimens of serum, one as early as possible in the acute phase of the disease and another from one to three weeks later When these are tested simultaneously, any significant increase in specific antibody which occurred during the interval is revealed

Although comparatively easy to carry out, these tests, with the exception of that for inhibition of hemagglutination, require considerable labor by experienced personnel Requests for their performance, therefore, should not be made unless the results are considered essential to the final estimate of the case In this connection it should also be pointed out that the serologic findings nearly always provide a diagnosis only in retrospect, since recovery frequently occurs before they can obtained

I shall now recapitulate very briefly a few of the more recent advances in knowledge of three diseases which may be of interest to members of this group The disorders I have chosen are acute herpetic gingivostomatitis, stomatitis and diarrhea of infants, and mumps

Acute herpetic gingivostomatitis was often formerly designated as aphthous stomatitis or Vincent's stomatitis The etiologic agent until a few years ago was unknown, but many had believed that the fusospirochetal organisms of Vincent were responsible In 1939, Dodd, Buddingh and Johnston[2] isolated the virus of herpes simplex from 27 of 28 cases of gingivostomatitis — a result which strongly suggested that this agent was actually the cause of the disease Since herpes virus, however, may frequently be isolated from the saliva of normal persons, the evidence was not complete until Burnet and Williams[3] showed that virus-neutralizing antibodies developed in the blood during the course of the illness

On the basis of these observations and the epidemiologic studies carried out by Burnet and his co-workers at about the same time, the condition is now generally regarded as a primary infection by the herpes virus Occurring most often in young children, but occasionally in adults, this initial attack is characterized by high fever and enlargement of the regional lymph glands, in addition to the distinctive reddening of the gums and the formation of vesicles on the buccal mucosa, the tongue and, in some cases, the tonsil and pharynx

Persons who have previously been infected with herpes virus and who continue to harbor it in their tissues also may develop stomatitis This condition is now described as recurrent herpetic stomatitis Scott, Steigman and Convey[4] have pointed out that in such cases the local lesions tend to be less severe and the generalized disturbances are very mild or absent Repeated attacks are common at any age Since individuals who constantly harbor the virus maintain a high level of antibody in the blood, no change in its concentration can be usually demonstrated as a result of an attack

In respect to these herpetic infections of the oropharynx, it is important to note in passing that Vincent's angina of the tonsil, for which the virus of herpes is not responsible, can, as Steigman and Scott[5] have recently shown, be easily distinguished from herpetic lesions of this organ

From the foregoing remarks it is apparent that in order to obtain complete evidence of primary herpetic gingivostomatitis it would be necessary to demonstrate the virus in the saliva or materials from the lesions, as well as the development of virus-neutralizing antibody during the course of the infection In practice the distinctive clinical picture, together with a positive serologic test, should be sufficient Laboratory diagnosis of recurrent herpetic stomatitis would depend upon the isolation of the virus in the presence of elevated and unchanging neutralizing antibody and perhaps the occurrence of typical intranuclear inclusions in the cells obtained from the lesions

Pediatricians have lately given much attention to another form of stomatitis which occurs predominantly in infants under six months of age and which is associated with diarrhea of varying severity This condition was first described by Buddingh and Dodd,[6] in 1944, who obtained evidence that a filtrable agent exhibiting certain similarities to herpes simplex was involved

Clinically, the disease is characterized by a sudden onset Vesicles appear usually on the tip and under surface of the tongue and less often on the gums and inner surface of the lips These lesions may persist from seven to 14 days In the very young infant the accompanying diarrhea, which may frequently prove fatal, is often the predominating feature, whereas the stomatitis may be so mild as not to be observed Older children and adults in contact with such cases may develop stomatitis without diarrhea It is probable that these individuals may transmit the disease to infants, although infection of the latter may also occur in the birth canal, since the virus has been demonstrated in the vaginal secretions of mothers whose children develop the disease

By inoculating the cornea of rabbits with swabbings from the mouth lesions or with stools, Buddingh and Dodd produced characteristic lesions By serial passage of emulsified infected cornea in these animals the virus has been maintained in the laboratory Bacteria-free filtrates of infected corneal suspensions likewise produced the characteristic lesions The development of virus neutralizing antibody during the course of the illness in infants was also revealed

Although Buddingh and Dodd, as well as other workers, have not always been able to repeat these experiments, there can be little doubt that a virus is the cause of this type of infant diarrhea In view of the great importance of the general problem of diarrhea of the newborn both in this country and in Europe, it is desirable that all those who frequently inspect the oropharynx should be acquainted with the observations of Buddingh and Dodd By bringing cases of the sort they have described to the attention of those interested in the disease from the experimental point of view, they can aid materially in advancing knowledge of this important subject

I have included the mumps virus in this discussion because it is one of the causes of deafness Much progress has been made in our understanding of mumps infections during the past 15 years[7] Within this period the etiologic agent has been definitely established as a filtrable virus, methods of propagating it in chick embryos and tissue cultures have been developed, as well as serologic techniques for its identification, which have proved particularly useful in the diagnosis where parotitis is not a prominent feature or cannot be observed, such as in certain cases of meningoencephalitis

By means of one of the serologic procedures like the complement fixation test it has been possible to show that inapparent infections by this virus frequently occurs Since there are good grounds for believing that such inapparent or subclinical infections establish an immunity as complete and durable as the overt disease itself, the test, when positive, indicates not only past infection but also that the individual is in nearly all instances immune to re-exposure The same information can also be obtained by inoculating a small quantity of the inactivated mumps virus into the skin In a large proportion of persons who have previously been infected, a hypersensitive reaction marked by erythema and a variable degree of induration develops after 24 to 48 hours at the site of injection In most individuals who have not been infected, little or no reaction is observed These two methods—the complement fixation and skin tests—may be employed to confirm a positive history of mumps or to obtain information concerning the occurrence of past infection when the history is doubtful or negative Accordingly, it would seem possible that in certain cases of deafness in which the cause is obscure, but in which the participation of the mumps virus is considered, these tests might prove helpful if not conclusive

BIBLIOGRAPHY

1 TOBEY H G Otitis Media with Effusion THE LARYNGOSCOPE (to be published)

2 DODD, K, BUDDINGH, G J, and JOHNSTON, L Herpetic Stomatitis *Amer Jour Dis Child*, 58 907, 1938

3 BURNET, F M and WILLIAMS, S W Herpes Simplex A New Point of View *Med Jour Australia*, 1 637, 1939

4 SCOTT, T F M STEIGMAN, A J and CONVEY, J H Acute Infectious Gingivostomatitis Etiology Epidemiology and Clinical Picture of a Common Disorder Caused by the Virus of Herpes Simplex *Jour A M A*, 117 999, 1941

5 STEIGMAN, A J, and SCOTT, T F M Evidence That Virus of Herpes Simplex Does Not Cause Vincent's Angina of the Tonsil *Proc Soc Exper Biol and Med*, 64 244, 1947

6 BUDDINGH, G J and DODD, K Stomatitis and Diarrhea of Infants Caused by a Hitherto Unrecognized Virus *Jour Pediat*, 25 105 1944

7 ENDERS, J F and LEVENS, J H Chapter on Mumps in Diagnostic Procedures for Virus and Rickettsial Diseases, edited by T M Rivers Amer Pub Health Assn, New York City, 1948, pp 139 164

PERSISTENT CRANIOPHARYNGEAL CANAL IN A LIVING ADULT *

WILLIAM WESLEY WILKERSON, JR , M D , and
LEE FARRAR CAYCE, M D ,
Nashville, Tenn

A peristent craniopharyngeal canal is an embryological anomaly which consists of an incomplete or a complete canal extending from the pharynx or from a blind end canal within the vomer through the septal area of the sphenoid sinuses to the hypophysis From the study of anatomical specimens this rare anomaly has been found to end distally in the vomer in a high percentage of cases, as would be indicated by the embryology of this area

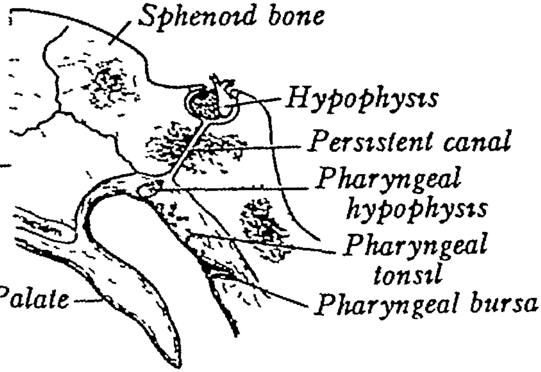


Fig 1 Relations of the hypophysis and pharyngeal hypophysis of the newborn showing in median section (×1) (From Arey's 'Developmental Anatomy' after Frazer W B Saunders Co)

---

*Read at the meeting of the Southern Section American Laryngological Rhinological and Otological Society Inc Washington D C Jan 10 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 2 1949

An extensive search of the literature has revealed no report of a case in which a craniopharyngeal canal was noted in a living human It is our belief, therefore, that this essay deals with the first reported case of a craniopharyngeal canal in a living person and is all the more rare because it was found in an adult

PLATE 2

Name of Investigator	Newborn	Per Cent
Le Double[23] ..	More common in boys	0 09
	Apes	30
	Rabbits	100

The incidence of the craniopharyngeal canal in the human, both in infancy and adulthood, and in other animals, is shown in these slides This is a composite tabulation comprising the results of many investigators From these statistics we note that a persistent craniopharyngeal canal in the human is neither atavistic nor directly inherited

HISTORY OF THE CRANIOPHARYNGEAL CANAL

Rathke,[33] the discoverer of the pouch which bears his name, mentioned a case of cerebral hernia through an opening in the sphenoid bone, in 1839 Rathke assumed that this hernia was induced by hydrocephalus which had developed prior to closure of the aperture through which the so-called Rathke's pouch entered the cranial cavity

Other articles on craniopharyngeal canals were written between 1839 and 1875 by Laurence,[27] Houel,[10] Wegelin,[51] Wallman,[50] Rippmann,[35], von Mihalkovics[48] and Landzert [1]

In 1878, Kulischer[20] observed a case in which hydrocephalus in the embryonal stage induced cerebral hernia through the craniopharyngeal canal In 1879, Parker and Bettany[29] found that the craniopharyngeal canal was always present in rabbits

In 1882, Froriep[12] mentioned the craniopharyngeal canal as having been determined in human embryos during the first three months

Description of the craniopharyngeal canal in the macerated human skull was published for the first time in 1886, by Romiti[37] He had examined about 800 crania and had found the craniopharyngeal canal only once in the skull of a child, five years old This skull was well developed and brachiocephalic On the under surface of the sphenoid bone, somewhat to the right of the median line, 6 mm from the sphenooccipital synchondrosis and 3 mm from the upper end of the vomer, there was an opening 1 mm in diameter It was the inferior opening of the craniopharyngeal canal, which in length measured 8 mm The superior opening lay in the region of the sella turcica, 2 5 mm to the right of the median line

PLATE 3 INCIDENCE OF CRANIOPHARYNGEAL CANAL

(Ancient Skulls and Cadavers)

Name of Investigator	Human	Per Cent	
Pende[30]	Human	0 3	
Rizzo[36]	Human	0 29	
Sokolow[39]	Human	0 3	(16 out of 5 281 adult skulls)
Le Double[23]	Human	0 20	
Rossi[38]	Human	0 24	(Examined 3 127 skulls)
Romiti[37]	Human	0 125	(Examined 800 skulls)
Average		0.2425	

In the following year, 1887, Suchannek[42] observed a case of persistence of the craniopharyngeal canal, in a four-year-old girl His preparation showed a repression in the pharynx

In the following year, 1887, Suchannek[42] observed a case of persistence of the craniopharyngeal canal, in a four-year-old girl His preparation showed a depression in the pharyngeal roof, exactly opposite the fossa of the hypophysis From this fossa, a mushroom-shaped, roundish formation of hypophyseal tissue protruded approximately 4 mm and was 3 5 mm in diameter There was also a small button-shaped exostosis on the right posterior clinoid process The brownish color of the hypophysis differentiated it from the covering of dura mater which immediately surrounded it and the adjoining bone lamella of the sphenoid body The existence of the exostosis on the right posterior clinoid process was explained by Suchannek[42] as a remnant of the middle trabecula of the cranium

In 1890, Steinberg[41] described a craniopharyngeal canal which he observed in the skull of a child, three to four years old

The Italians were assiduous in their research on this subject between 1890 and 1900 Maggi,[25] Rossi[38] and Rizzo[36] made extensive studies on human skulls

Testut,[43] in 1893, stated, "One finds occasionally in newborn infants a canal which starts from the sella turcica and ends in the pharynx This is the craniopharyngeal canal, well described by Landzert,[21] and enclosing with a few vessels a prolongation of the dura mater Romiti[37] has just observed this canal in a cadaver of a small girl of five years"

Spee,[40] in 1896, reported "As an extremely rare formation due to inhibition, we find in the floor of the hypophyseal fossa the persistence of a canal, the craniopharyngeal, which perforates the basal sphenoid, and is looked upon as the site of departure of the hypophysary duct, which has remained open In the hare, this aperture is typical"

Rauber,[34] in 1902, discusses the upper orifice of this median canal in the pituitary fossa, which passes through the body of the sphenoid bone and terminates on its lower surface He says "It contains the duct of the hypophysis, but it must not be mistaken for the venous canals, which also occur In this connection we should again note the fact that the upper orifice of the canal usually occurs in the lowest portion of the sella in the median plane"

It was first suggested by Mott and Barrett,[28] in 1899, that craniopharyngeomas were related to craniopharyngeal canals This theory was proved true by Erdheim[9] in 1904

There are few references to craniopharyngeal canals to be found in the literature of the twentieth century Most of these articles deal with conditions in various mammals other than man Barrier Gustave et Petit,[2] in 1908, and Zannini,[53] in 1922, wrote of the craniopharyngeal canal in the horse The latter article deals in an instructive manner with the human phase of this subject

Levi,[24] in 1909, described a craniopharyngeal canal in an acromeglia

Sokolow,[39] Waldeyer,[40] Cave,[5] Dursy,[8] Arai[1] and Mannu[26] reported the characteristics, frequency, etc, of the craniopharyngeal canal in fish, reptiles and mammals other than human

EMBRYOLOGY

In a 7 mm embryo the telencephalic portion of the forebrain has grown laterally and forward Rathke's[33] pouch at this stage is merely a depression formed by stresses of the surrounding structures with the forewall of the pouch being composed of ectoderm pushing against the posterior wall of the forebrain

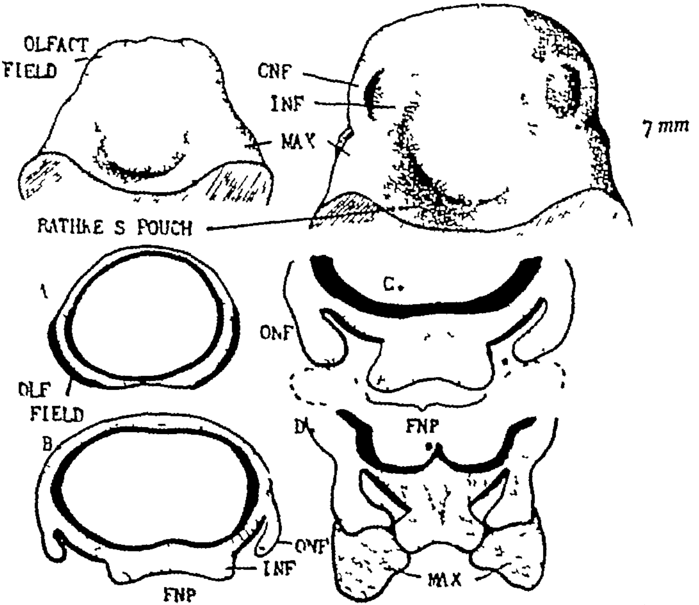


Fig 4 The two upper figures show the lower aspects of the projecting heads of embryos of 4 and 7 mm In the 7 mm specimen the growth of the telencephalic part of the forebrain increasing in size laterally as well as forward has brought the olfactory fields below the head instead of at its anterolateral aspect as in the 4 mm embryo Outlines of sections through these two heads are given in (A) and (B) below and on the left. These show formation of olfactory pits and frontonasal process (FNP) Diagrams of further changes are given in (C) and (D) The maxillary processes are indicated by interrupted lines in (C) showing where they will come into position as in (D) (ONF) (INF) outer or lateral and inner or medial nasal folds (MAX) maxillary process (from Buchanan's Anatomy) From Frazer's A Manual of Embryology Williams and Wilkins Co

Rathke's[13] pouch lies between the bucopharyngeal membrane and the forebrain with the maxillary processes exerting influence from their lateral positions

The mesodermal thickening causes the pouch to elongate At this stage the roof of the pharynx is the canal's upper border The growth of the sphenoid bone compresses the neck of the pouch so that by the 28 mm to 36 mm stage only the canal proper remains

The canal proper, that portion of this ectodermal elongation connecting the base of the brain and the roof of the mouth, is encroached upon by the septal processes of the maxillary mesoderm in forming the nasal septum

A craniopharyngeal canal may, therefore, extend into the nasal septum in case the septal processes fail to compress the anterior end of this pouch by the 20 mm stage

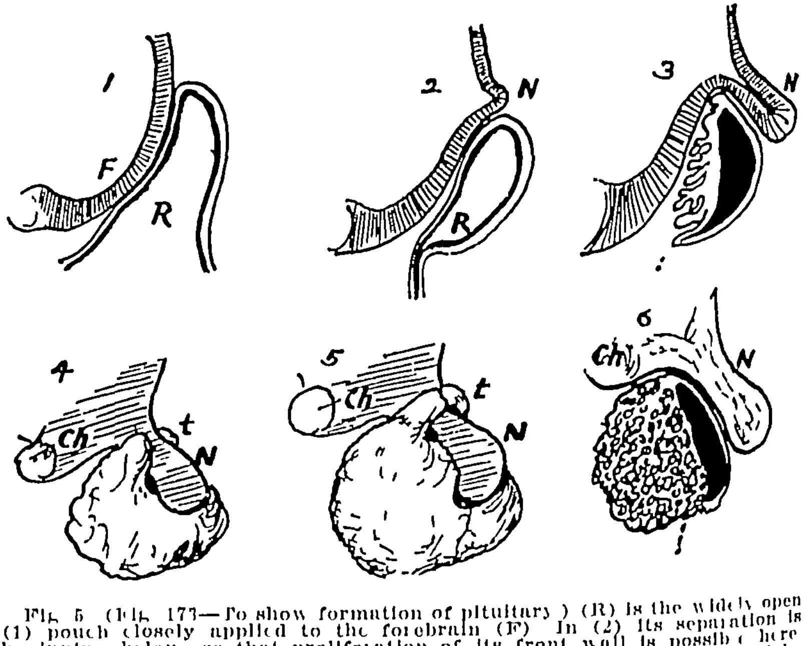


Fig 5 (Fig 173—To show formation of pituitary) (R) is the widely open (1) pouch closely applied to the forebrain (F) In (2) its separation is beginning below so that proliferation of its front wall is possible here (3) A similar process occurs laterally At the same time the neural lobe (N) grows out from the forebrain and forms a club-shaped process above and behind the pouch In (4) the completely separated pouch is forming by proliferation the anterolateral lobes and corneal upgrowths (t) begin to surround the neck of the neural lobe to form the pars tuberalis (5) The neural lobe lies on the posterior wall of the pouch (6) which is the pars intermedia a transverse section would show this curved around the anterior and lateral aspects of the pars neuralis (Ch) Chiasma

The cranial portion of Rathke's pouch dilates and forms the anterior lobe of the hypophysis The fact that such a development occurs from this canal explains the reason pituitary rests are found in the pharynx and in a persistent craniopharyngeal canal

PLATE 6 ESTIMATED TIME OF CLOSURE OF RATHKE S POUCH

Tourneux[45]	Beginning of third fetal month
Hertwig[15]	Shortly before birth
Pende[30]	Beginning of third fetal month
Levi[24]	Between second and third fetal month
Le Double[23]	Excessively rare one month after birth
Escat[10]	Occasionally after birth
Landzert[21]	

Table 6 (From Frazier s 'A Manual of Embryology Williams and Wilkins Co

DESCRIPTION WITH DISCUSSION

The description of the craniopharyngeal canal, rarely found in the living, is derived from embryological and anatomical studies

The canal, according to Mannu,[26] has an average length of 2 5 cm The internal orifice, situated anteriorly in the hypophyseal fossa, is either round or elliptical in shape The external orifice is of the same shape, although larger, and is 1 to 2 mm from the vomer The external opening is located on the face of the sphenoid bone, usually in the intraseptal region Mannu found in his three cases that the canals were not uniform in calibre, being narrower in the midportion He further stated that the canals permitted the passage of a medium sized horse hair

Cave[5] found a craniopharyngeal canal in a skull of a 38-year-old man with an internal orifice 3 5 mm in diameter A probe introduced into this orifice was passed downward and forward for 16 mm through the medial septum of the sphenoid sinus to a vomerine termination in the nasal septum Concomitant departures from the normal were manifested in the same subject

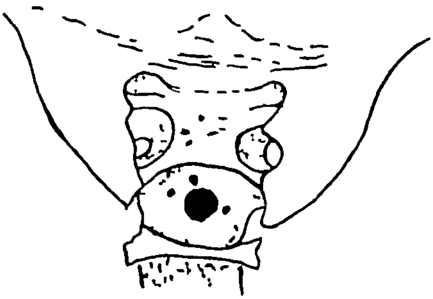


Fig. I

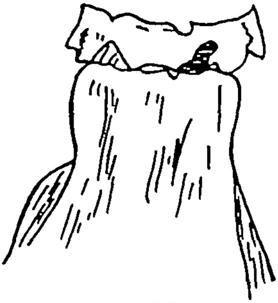


Fig. II

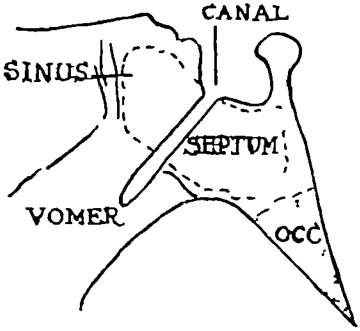


Fig. III

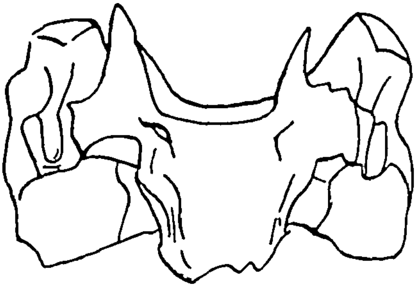


Fig. IV

Fig 7 Presents a circular hole 3 5 mm in diameter the mouth of the craniopharyngeal canal through which a probe can be passed 16 mm downward and forward through the medium septum of the sphenoid sinuses to a vomerine termination Vascular foramen are also seen Other abnormalities are noticeable

The transverse bar of the dorsum sella is attached to the main body of the bone by fibrous tissue only

The relations of the canal (from skiagram)

Shows enlargement of a vertebral body indicative of increased pituitary activity similar to that noted in acromegalia.

(From Cave s The Craniopharyngeal Canal in Man and Anthropoids Jour Anat Vol 65 1931)

Tweedie and Keith[46] reported a case in which the pituitary body was located in a cleft of the palate This case had a harelip and a groove on the columella of the nose The mass extended from the roof of the nasopharynx and, therefore, was a herniation through the craniopharyngeal canal Six other cases of herniation have been reported

Waldeyer[49] in his study of craniopharyngeal canals also found communications between the cavity of the sphenoid sinus, through the inferior wall and the pharynx to be fairly common Undoubtedly these openings may be a considerable factor in the transmission of infections from the pharynx to the sphenoid sinus and vice versa

Citella[6] found, in addition to the habitual prolongation of the dura mater, several small blood vessels which connected with those of the pharyngeal vault When he injected these vessels with India ink at the fundus of the sella turcica, the superficial and deep vessels of the pharyngeal vault were deeply stained This is, therefore, an unusual pathway of intracranial infections originating in the hyperpharynx vault

The contents of the canal have been described, as a single fibrous strand by Prenant[31] and Landzert,[21] as connective tissue and blood vessels by Waldeyer[49] and Mingazzini,[27] as a prolongation of the dura with blood vessels by Citelli,[6] Sokolow,[39], Testut[43] and W Krause,[19] or as perichondrium by Froriep [12]

Von Luschka,[47] Froriep[12] and Suchannek[42] found hypophyseal rests in the canal Arai[1] found a true accessory hypophysis in the canal Haberfeld[14] and Calori[4] found craniopharyngeal canals filled with pituitary glandular tissue which protruded into the hyperpharynx and could have been mistaken for polypi or adenoid tissue

Killian,[15] in 1888, stated that nests of pituitary tissue may occur in the nasopharynx Later, Haberfeld[14] and others found these nests of pituitary tissue to be a constant finding in the nasopharynx of the human

CRANIOPHARYNGIOMAS

Craniopharyngiomas, which are encapsulated squamous epithelial tumors, can be divided into two groups, the solid and the cystic types The latter predominates in a large series of cases The solid tumors commonly are nonmalignant Malignancy in this area usually arises from within the nasopharynx

Craniopharyngiomas are more often seen in children, constituting 10 to 13 per cent of all intracranial new growths in childhood These tumors, however, have occurred at varying ages, four cases having been reported in patients over 60 years of age

Haberfeld's[14] article on new growths which develop from hypophyseal rests is elucidating

In an article by Ingraham and Scott[17] it was stated that, "Erdheim[9] had pointed out that in the embryonic development *of the hypophysis from a union of infundibular and buccal* pouch components, the epithelium comprising the original forward wall of Rathke's[33] pouch comes eventually to form the anterosuperior covering of the anterior lobe of the hypophysis Squamous cell rests occupying this location have been observed repeatedly in autopsy studies in the absence of neoplasm Proliferation of these squamous epithelial cells results in the epithelial masses with cyst formation that are known as suprasellar cysts, hypophyseal duct tumors, adamantinomas and craniopharyngiomas Cushing[7] coined the term 'craniopharyngioma' because he felt it was accurately descriptive of the tumor's unique origin Bremer[3] recently pointed out that from the embryological point of view this widely accepted term is not accurate, since Rathke's[33] pouch is a diverticulum of the buccal cavity and not of the embryonic pharynx"

Only a superficial general discussion of the pathology of craniopharyngiomas is indicated in this review An hypopyseal neoplasm may be a small cyst or a large multiloculated cyst with islands of solid squamous epithelial tissue It is in these solid masses that calcareus deposits are found, particularly at the base of the mass near its attachment where there is ample blood supply These calcium deposits, when seen in a Roentgenogram, are pathognomonic of a craniopharyngiomatous tumor The contents of the cyst are degenerated, desquamated, liquefied epithelial cells of a brownish color Cholesterol crystals are found in this liquid, floating on the surface

The solid tumors, adamantinomas, are epithelial masses in which no cells or debris have undergone liquefaction

The consensus of opinion indicates that intracranial surgery for craniopharyngioma is the treatment of choice despite almost 100 per cent mortality, which results from the difficulty in entirely extirpating the growth Intracranial surgery however, serves to lengthen life and prevent blindness for a period of time When the mass is incompletely removed, the cystic material usually ceases to drain as the cyst becomes adherent to the arachnoid, however, should the mass be connected with the ventricular system, the drainage would continue Results show that radiation is of little value, however, it was recommended by Frazer [11]

Although certain anatomical considerations and accepted surgical criteria would be violated by the opening of craniopharyngeal cysts through the nasopharynx, it is worthy of consideration, when possible, since the mortality rate of intracranial surgery is so very high Tonnis[14] reports such a surgical procedure

Globus and Gang[13] published a comprehensive article on "Craniopharyngioma" in 1945, an outline of which is listed below

"*1* Fourteen cases of hypophyseal duct tumor are described

"*2* The tumors were found to be derived from residues of the so-called craniopharyngeal (cranio-oral) duct

"*3* The tumors were subgrouped as cystic and solid, and in each subgroup there were those which were identified as papillomatous and those which were partially or dominantly adamantinomatous

"*4* The tumors often implicated the floor of the third ventricle, or broke through it to expand into the third ventricle, thereby causing hypothalmic disorders

"*5* Clinically, the recorded cases presented constellations of symptoms and signs which offered substantial diagnostic leads Among the latter, in order of their significance and in varying degree, were

Craniopharyngiomas are more often seen in children, constituting 10 to 13 per cent of all intracranial new growths in childhood These tumors, however, have occurred at varying ages, four cases having been reported in patients over 60 years of age

Haberfeld's[11] article on new growths which develop from hypophyseal rests is elucidating

In an article by Ingraham and Scott[12] it was stated that, "Erdheim[9] had pointed out that in the embryonic development of the hypophysis from a union of infundibular and buccal pouch components, the epithelium comprising the original forward wall of Rathke's[33] pouch comes eventually to form the anterosuperior covering of the anterior lobe of the hypophysis Squamous cell rests occupying this location have been observed repeatedly in autopsy studies in the absence of neoplasm Proliferation of these squamous epithelial cells results in the epithelial masses with cyst formation that are known as suprasellar cysts, hypophyseal duct tumors, adamantinomas and craniopharyngiomas Cushing[7] coined the term 'craniopharyngioma' because he felt it was accurately descriptive of the tumor's unique origin Bremer[3] recently pointed out that from the embryological point of view this widely accepted term is not accurate, since Rathke's[33] pouch is a diverticulum of the buccal cavity and not of the embryonic pharynx"

Only a superficial general discussion of the pathology of craniopharyngiomas is indicated in this review An hypopyseal neoplasm may be a small cyst or a large multiloculated cyst with islands of solid squamous epithelial tissue It is in these solid masses that calcareus deposits are found, particularly at the base of the mass near its attachment where there is ample blood supply These calcium deposits, when seen in a Roentgenogram, are pathognomonic of a craniopharyngiomatous tumor The contents of the cyst are degenerated, desquamated, liquefied epithelial cells of a brownish color Cholesterol crystals are found in this liquid, floating on the surface

The solid tumors, adamantinomas, are epithelial masses in which no cells or debris have undergone liquefaction

The consensus of opinion indicates that intracranial surgery for craniopharyngioma is the treatment of choice despite almost 100 per cent mortality, which results from the difficulty in entirely extirpating the growth Intracranial surgery however, serves to lengthen life and prevent blindness for a period of time When the mass is incompletely removed, the cystic material usually ceases to drain as the cyst becomes adherent to the arachnoid, however, should the mass be connected with the ventricular system, the drainage would continue Results show that radiation is of little value, however, it was recommended by Frazer[11]

Although certain anatomical considerations and accepted surgical criteria would be violated by the opening of craniopharyngeal cysts through the nasopharynx, it is worthy of consideration, when possible, since the mortality rate of intracranial surgery is so very high Tonnis[44] reports such a surgical procedure

Globus and Gang[13] published a comprehensive article on "Craniopharyngioma" in 1945, an outline of which is listed below

"*1* Fourteen cases of hypophyseal duct tumor are described

"*2* The tumors were found to be derived from residues of the so-called craniopharyngeal (cranio-oral) duct

"*3* The tumors were subgrouped as cystic and solid, and in each subgroup there were those which were identified as papillomatous and those which were partially or dominantly adamantinomatous

"*4* The tumors often implicated the floor of the third ventricle, or broke through it to expand into the third ventricle, thereby causing hypothalmic disorders

"*5* Clinically, the recorded cases presented constellations of symptoms and signs which offered substantial diagnostic leads Among the latter, in order of their significance and in varying degree, were "*a* Vegetative disturbances, such as retarded growth, disturbance in fat distribution with occasional underdevelopment of secondary sex characteristics (Froelich's syndrome), imbalance in water metabolism (polydipsia and polyuria), amenorrhea, loss of libido, pulse and temperature discord, anorexia, obstinate constipation

"*b* General manifestation of increased intracranial tension, which included headache, accompanied by nausea and vomiting, papilledema and mental retardation

"*c* Signs due to direct pressure by tumor, optic atrophy, loss of acuity of vision, hemianopic field defects, pyramidal and cerebellar signs

"*d* X-ray findings, consisting of calcifications in or about the sella turcica

"*6* Surgical intervention in many instances resulted in but temporary relief and, at best, in a relatively longer survival period"

CASE REPORT

J F W F, age 19 The patient's only otolaryngological complaint was the inability to breathe through the left naris Two previous surgical procedures had been but temporarily successful The history indicated the earlier presence of sinusitis on the left side The family history was negative

The examination of the right naris was negative The left naris was filled with a glassy mucoid secretion which was removed by suction The floor of the nose was elevated but only on the involved side The entire nares were slightly congested, but no pus was seen The anterior cervical and the submaxillary glands on the left side were moderately enlarged The nasopharynx appeared to be normal however, with a mirror the left choanae was seen to be occluded with what appeared to be a dense grayish membrane The occluding wall protruded posteriorly in its central portion, and a ridge approximately 1 mm thick was noted on its inferior border With the use of probes a diagnosis of unilateral complete bony occlusion of the left choanae was made A Roentgen examination revealed choanal atresia and also an increase in the density of the left frontal ethmoid and maxillary sinuses Other than that described above the ear nose and throat examination was negative The general examination was negative with the exception of endocrine disturbances

Under general anesthesia, both the posterior end of the septum and the occluding wall were removed The technique of this surgical procedure including the use of electrically driven burrs was described by Wilkerson and Cayce[52] in a previous article which included a brief report of this case

While using a probe to determine whether or not the atretic wall had been completely removed an irregular round opening was found in what we thought it to be the face of the left sphenoid sinus This defect consisted of a canal beginning in the superior central portion of the anterior surface of the sphenoid and extending posteriorly superiorly to the sella turcica The walls of the canal were of bone overlying which a thin lining of soft tissue was noted during the examination of this area with a probe

The orifice of the canal was estimated to be 3 to 5 mm in diameter and the length 2 cm

Fig 8 Probe in persistent craniopharyngeal canal

Many Roentgen examinations were made with probes inserted in the canal Lipiodol was introduced into the sinuses several times using the Proetz[32] method however the contrasting media at no time entered the canal probaby due to a barrier of the soft tissue within the canal

Two possible diagnoses were considered a craniopharyngeal canal or a congenital dehiscence in the face of the sphenoid bone The latter was disproved by probing both sphenoid sinuses extensively during which "*a*. Vegetative disturbances, such as retarded growth, disturbance in fat distribution with occasional underdevelopment of secondary sex characteristics (Froelich's syndrome), imbalance in water metabolism (polydipsia and polyuria), amenorrhea, loss of libido, pulse and temperature discord, anorexia, obstinate constipation

"*b* General manifestation of increased intracranial tension, which included headache, accompanied by nausea and vomiting, papilledema and mental retardation

"*c* Signs due to direct pressure by tumor, optic atrophy, loss of acuity of vision, hemianopic field defects, pyramidal and cerebellar signs

"*d* X-ray findings, consisting of calcifications in or about the sella turcica

"*6* Surgical intervention in many instances resulted in but temporary relief and, at best, in a relatively longer survival period"

CASE REPORT

J F , W F, age 19 The patient's only otolaryngological complaint was the inability to breathe through the left naris Two previous surgical procedures had been but temporarily successful The history indicated the earlier presence of sinusitis on the left side The family history was negative

The examination of the right naris was negative The left naris was filled with a glassy mucoid secretion which was removed by suction The floor of the nose was elevated, but only on the involved side The entire nares were slightly congested, but no pus was seen The anterior cervical and the submaxillary glands on the left side were moderately enlarged The nasopharynx appeared to be normal however, with a mirror the left choanae was seen to be occluded with what appeared to be a dense grayish membrane The occluding wall protruded posteriorly in its central portion and a ridge approximately 1 mm thick was noted on its inferior border With the use of probes a diagnosis of unilateral complete bony occlusion of the left choanae was made A Roentgen examination revealed choanal atresia and also an increase in the density of the left frontal ethmoid and maxillary sinuses Other than that described above the ear, nose and throat examination was negative The general examination was negative with the exception of endocrine disturbances

Under general anesthesia, both the posterior end of the septum and the occluding wall were removed The technique of this surgical procedure including the use of electrically driven burrs, was described by Wilkerson and Cayce[52] in a previous article, which included a brief report of this case

13 Globus Joseph H., and Gang Kenneth M Craniopharyngioma and Suprasellar Adamantinoma *Jour Mt Sinai Hosp* 12 220-276 1945-1946

14 Haberfeld Walther Die rachendachhypophyse andere hypophysengangreste und deren bedeutung fur die pathologie *Beitr z path anat u z allg pathol., Zieglers* 46 133 232 1909

15 Hertwig O Elementi di Embriologia dell uomo E dei Vertebrati Case Ed Vallardi, Milano 1913 p 433

16 Hovel Charles Nicolaas Memoire sur l encephalocele congenitale *Arch generales de Med* 2 409 569 1859

17 Ingraham, Francis D., and Scott H William Craniopharyngiomas in Children. *Jour Pediat* 29 95-116 1946

18 Killian Gustav Uber die Bursa und Tonsilla pharyngea *Morph Jahrb* s 618 1888

19 Krause, Wilhelm Specielle und makroskopische anatomie *Handb der menschlichen anatomie* Bd 2 1879

20 Kulischer, Ruvim Moiseyevich Ein Fall von Hirnbuch durch das Schadelgewolbe und den Schadelgrund *Beitr z Anat u Histologie von Landzert* Heft 2 1878

21 Landzert Th Ueber den Canalis craniopharyngeus am Schadel des Neugeborenen. *St Petersburger med Ztschr.,* 15 133 139 1868

22 Laurence J Z On Encephalocele *Trans Medico-chir London* 39 307 1856

23 Le Double, Anatole F Traites des variations des os du crane de l'homme et de leur signification au point de vue de l anthropologie zoologique Paris Vigot Freres 1903

24 Levi, Ettore Persistenza del canale cranio-faringeo in due crani acromegallici. *Riv crit clin med.,* 10 361-373 1909

25 Maggi, Leopold Intorno al canale cranio faringeo in alcuni rosicanti. *Ren R Inst Lomb Sc Lett.,* S 2 23 719 1890

Intorno al foro pituitario ectocranico nei mammiferi. *Rend R Inst Lomb Sc Lett.,* 26 703 1893

Il canale cranio faringeo negli ittiosauri ecc. *Pend Inst Lomb Sc Lett.,* 31 761 1898

Intorno al canale cranio faringeo nei felidi e jenidi *Boll scient Maggi Zoja ecc.,* Pavia 1895-1896 p 93

Foro pituitario ectocranico ed interparietale in un neonato di Pteropus medius *Rend R Inst Lomb Sc Lett.,* 28 813 1893

Il Canale cranio faringeo negli antropoidi *Rend R Inst Lomb Sc Lett.,* S 3 24 138 1891

26 Mannu Andrea Sul canalis cranio pharyngeus *Boll soc med di Parm* Ser 2 14 40-43 1921

27 Mingazzini, G Anatomia clinica dei centri nervosi. Torino 1913 p 515

28 Mott Frederick Walker, and Barrett J O Wakelin Three Cases of Tumor of the Third Ventricle *Arch Neurol Path* from the Path Lab of London County Asylums Claybury Essex 1 417-439 1899

29 Parker, W K., and Bettany G T Die Morphologie des Schadels Stuttgart. Sc Mit vielen Abbildungen im Text 1879

30 Pende, Nicolo Endocrinologia. Case Ed Vallardi, 1916

31 Prenant Auguste Elements d Embryologie de l homme et des vertebres Paris 1891-6 livr., 2 p 555

procedure the canal was located specifically within the septal wall lying between the cavities of the sphenoid sinuses A definite diagnosis of craniopharyngeal canal was then established

In view of the fact that the anterior lobe of the hypophysis is formed from the craniopharyngeal canal it is interesting to note that this patient suffered from endocrine disturbances Her internist found from a clinical examination, including a basal metabolic rate that she suffered from hypothyroidism At the age of 19 without pelvic infection or irradiation she continued to have a secondary amenorrhea

The current history of this patient has now been followed for two years since the atresial surgery She has presented a consistently negative neurological picture

SUMMARY

Concomitant congenital defects are interesting in this particular case because of their rarity The inhibition of embryological development, when resulting in a craniopharyngeal canal, may also, in some manner, cause a deficiency of the anterior lobe of the hypophysis, which probably accounts for the patient's hypothyroidism and secondary amenorrhea

BIBLIOGRAPHY

1 Arai, Harujiro Der inhalt des canalis craniopharyngeus *Anat hefte*, 1 33 411 451, 1907

2 Barrier Gustave et Petit, Gabriel Manuel de l anatomie et de dissection du cheval Osteologie, Paris 1908 p 11

3 Bremer J L Personal communication

4 Calori, Luigi Su varie particolarita osteologiche della base del cranio umano *Mem R Accad scienze Ist*, Bologna 5 2 297 311 1891 1892

5 Cave, A J E The Craniopharyngeal Canal in Man and Anthropoids *Jour Anatm*, 65 363 367, 1931

6 Citelli, Salvatore Sur la frequence relative du canal craniopharyngien chez les enfants et les jeunes gens et sur l'importance de ce fait pour ma theorie *Ann d mal de l oreille*, etc, 39 4 338 341, 1913

7 Cushing, Harvey Intracranial Tumors Springfield, Ill Charles C Thomas, 1932, pp 93 02

8 Dursy, Emil Zur Eentwickelungsgeschichte des Kopfes des Menshen und der hoheren Wirbelthiere 8° Mit Atlas in 4° 1869

9 Erdheim Jakob Ueber hypophysengangsgeschwulste und hirncholesteatome *Sitzungsb d akad d wissensch* Math nature, cl, 113 537 726 1904

10 Escat, Jean Marie Etienne Evolution et transformation anatomique de la cavite naso pharyngienne *These de Paris*, 1894

11 Frazer, J Ernest S *Proc Anat Soc*, Nov 25 1910

12 Froriep, August von Kopftheil der Chorda dorsalis bei menschlichen Embryonen *Beit z Anatomie u Embryologie als Festgabe fur J Henle*, pp 26 40 1882

13 Globus, Joseph H, and Gang, Kenneth M Craniopharyngioma and Suprasellar Adamantinoma *Jour Mt Sinai Hosp*, 12 220 276, 1945 1946

14 Haberfeld Walther Die rachendachhypophyse andere hypophysengangreste und deren bedeutung fur die pathologie *Beitr z path anat u z allg pathol*, *Zieglers* 46 133 232 1909

15 Hertwig, O Elementi di Embriologia dell uomo E dei Vertebrati Case Ed Vallardi Millano 1913 p 433

16 Houel, Charles Nicolaas Memoire sur l encephalocele congenitale *Arch generales de Med*, 2 409 569 1859

17 Ingraham, Francis D and Scott H William Craniopharyngiomas in Children *Jour Pediat*, 29 95-116 1946

18 Killian Gustav Uber die Bursa und Tonsilla pharyngea *Morph Jahrb*, s 618 1888

19 Krause Wilhelm Specielle und makroskopische anatomie *Handb der menschlichen anatomie* Bd 2 1879

20 Kulischer Ruvim Moiseyevich Ein Fall von Hirnbuch durch das Schadelgewolbe und den Schadelgrund *Beitr z Anat u Histologie von Landzert*, Heft 2 1878

21 Landzert, Th Ueber den Canalis craniopharyngeus am Schadel des Neugeborenen *St Petersburger med Ztschr*, 15 133 139 1868

22 Laurence, J Z On Encephalocele *Trans Medico-chir*, London 39 307, 1856

23 Le Double, Anatole F Traites des variations des os du crane de l'homme et de leur signification au point de vue de l anthropologie zoologique Paris Vigot Freres, 1903

24 Levi, Ettore. Persistenza del canale cranio faringeo in due cranii acromegallici *Riv crit clin med* 10 361-373 1909

25 Maggi, Leopold Intorno al canale cranio faringeo in alcuni rosicanti *Ren R Inst Lomb Sc Lett* S 2 23 719 1890

Intorno al foro pituitario ectocranico nei mammiferi *Rend R Inst Lomb Sc Lett* 26 703, 1893

Il canale cranio faringeo negli ittiosauri ecc *Rend Inst Lomb Sc Lett*, 31 761 1898

Intorno al canale cranio faringeo nei felidi e jenidi *Boll scient Maggi, Zoja, ecc*, Pavia 1895 1896 p 93

Foro pituitario ectocranico ed interparietale in un neonato di Pteropus medius *Rend R Inst Lomb Sc Lett* 28 813 1893

Il Canale cranio faringeo negli antropoidi *Rend R Inst Lomb Sc Lett* S 3 24 138 1891

26 Mannu Andrea Sul canalis cranio pharyngeus *Boll soc med di Parm* Ser 2 14 40-43 1921

27 Mingazzini G Anatomia clinica dei centri nervosi Torino 1913, p 515

28 Mott Frederick Walker and Barrett J O Wakelin Three Cases of Tumor of the Third Ventricle *Arch Neurol Path* from the Path Lab of London County Asylums Claybury Essex 1 417-439 1899

29 Parker, W K and Bettany G T Die Morphologie des Schadels Stuttgart 8° Mit vielen Abbildungen im Text 1879

30 Pende Nicolo Endocrinologia Case Ed Vallardi 1916

31 Prenant Auguste Elements d Embryologie de l homme et des vertebres Paris 1891 6 livr 2 p 555

32 Proetz, Arthur W Essays on Applied Phys
Ed St Louis Annals Publ Co, 1941

33 Rathke, Heinrich Entwickelungsges der na

34 Rauber, A Lehrbuch der Anatomie des
Aufl, Bd 1, 1902

35 Rippmann, Theodor Ueber einen bisher n
multipler Intrafotation in und ausserhalb der Sch
Zurich 4° 1865

36 Rizzo, Agostino Canale cranio faringeo f
parietali e preinterparietali nel cranio umano *Mo*
1901

37 Romiti Guglielmo Sopra il canale crani
sopra la rasca ipofisaria o tasca die Ratke Atti d
scienze Naturali, Vol VII, 1886

38 Rossi, Umberto Il canale cranio faringeo
Monitore Zoologico italiano, 2 117, 1891

39 Sokolow, Paul Der canalis cranio-pharyn
physiol, *Anat abt Jahr*, pp 71 96, 1904

40 Spee, Ferdinand Graf von *Skelettlehre* 2
Jena, 1896 287 pp Forms 2 abt., v 1 of Han
menschen, edited by Karl von Bardeleben

41 Sternberg, Maximilian Ein bisher nicht
Keilbein des Menschen und mancher Saugethiere
siol, *Anat Abt*, 1890, p 304

42 Suchannek, Hermann Ein Fall von Pers
ganges *Anat Anzeiger*, 2 520, 1887

43 Testut, Leon Trattato di anatomia unan
p 148

44 Tonnis W Zur behandlung der hypop
Ztschr f Psychiatr, 110 244 251, 1939

45 Tourneux, J P Pedicule hypophysaire e
chez l'homme et chez le chien (Canal cranio pha
laires) *Jour Anat et Physiol*, 48 233 258 1912

46 Tweedie, Alexander R, and Keith, Arthu
tary, with Other Congenital Anomalies of the Nos
Roy Soc of Med Proc, *Laryngol Sec*, London 4

47 von Luschka Hubert Der Hirnanhang
Menschen Berlin, 1860

48 von Mihalkovics, Victor Entwickelungsg
Tafeln Leipzig 4° 1887

49 Waldeyer, W Bemerkungen uber gruben
besonderheiten am korper des grundbeins *Inte*
u Physiol, 21 311 318, 1905

50 Wallmann Heinrich Einige Falle von H
Wchnschr, 13 292 308 1863

51 Wegelin, Karl Ein Beitrag zu den par
des Menschen Epignathus Bericht uber die
schen naturwissenchaftlichen Gesellschaft St Ge

52 Wilkerson, W W, and Cayce, Lee F (
sion *Trans Amer Acad Ophth and Otol*, Jan

53 Zannini, Prosper Der canalis cranio
Anat anz, 55 441-456, 1922

POSTNASAL DISCHARGE [*]

BEN L BRYANT, M D ,
Los Angeles, Calif

What is the most common complaint voiced in the rhinologist's office today? Postnasal discharge — alone or in company with other related symptoms This endeavor, therefore, is not to investigate the source and cause of some rare phenomenon, nor to present a novel method of combining and utilizing available therapeutic substances in fulminating diseases, nor yet to delineate a modification of a particular surgical procedure — it is an attempt to focus attention on a conservative manner of treating a remarkably frequent cause of this most common complaint, supported by microscopic studies of the tissues involved

For years, it has been an observation of the author that in patients complaining of excessive postnasal discharge — with or without demonstrable sinus disease — there can be found, almost invariably, enlargement of the posterior tips of the inferior turbinates This hypertrophy is not always visible on casual inspection of the nose, nor even by posterior rhinoscopy It should be emphasized at once that sometimes this change can be visualized only by means of the nasopharyngoscope In other instances, depending upon various factors, such as the degree of hypertrophy, the form of the turbinal body, and the architecture of the nose, the local change can be seen readily by anterior rhinoscopy, especially if it has reached the almost pendent "raspberry" stage This type can

---

[*] Read at the meeting of the Western Section American Laryngological Rhinological and Otological Society Inc. Los Angeles Calif , Jan. 29 1949

Acknowledgment is made to the Good Hope Clinic for the availability of part of the material presented herein, and also to the Pathology Department of the Hospital of the Good Samaritan for assistance in the biopsy studies

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 9 1949

scarcely be overlooked, but that which is not visible by anterior rhinoscopy — and which is found to be strikingly pronounced when viewed with the nasopharyngoscope—can be, and all too often is overlooked and receives no attention This implies the importance — indeed, the necessity of including inspection with the nasopharyngoscope in every routine examination of the nose If this is omitted, much valuable diagnostic information relative to the posterior part of the nose and the nasopharynx will be precluded

The posterior tip hypertrophy or hyperplasia has been variously explained in the past One popular notion holds that it results from the insult of purulent or mucopurulent drainage from diseased sinuses, ergo, that it does not occur without pre-existent sinus disease This has been one of the factors leading to much of what most of us will agree has been poorly indicated, superfluous and unnecessarily radical sinus surgery in the past, and who can number the individuals who, after such surgery, continue to have excessive postnasal discharge as a result of the neglect of the posterior tip enlargement?

It occurred to me some years since that perhaps in many of these cases the cart and the horse had been interchanged, and that actually the purulent sinusitis was an end-result of a series of phenomena instituted by the hypertrophy of the posterior tips — and that it might be reversible

This reasoning was prompted by the very many examples of postnasal drainage persisting after sinus surgery, which ceased when the neglected posterior tip hypertrophy had been adequately treated It was supported by the very many examples of postnasal drainage which ceased without surgery, when the same treatment was used

The further consideration and more careful examination of the posterior portion of the turbinates was rewarded, as I observed the consistency not only with which they were found to be hypertrophied in these cases, but also with which the postnasal discharge decreased and ultimately stopped as they were treated All of this is even more striking when the symptoms and findings are unilateral — as has been the case repeatedly

In many instances, X-ray evidence of sphenoethmoidal sinusitis has disappeared after the return to normal of the turbinal tips, with no treatment other than that directed to their hypertrophy In other cases of purulent sphenoethmoiditis, treatment of the posterior sinuses, including the Proetz displacement therapy, has been effective only after the enlargement of the turbinate tips has resolved under local treatment, furthermore, maxillary sinusitis, which is certainly frequently merely a further extension of sphenoethmoiditis, has likewise repeatedly cleared, not from local treatment to the antrum but only when attention has been given to the turbinate tips

There need be no wonder at these observations if the fundamental physiology of the nose and accessory sinuses is kept in mind The two requisites for normal physiological function of this area are aeration and drainage Normal drainage resulting from ciliary action is toward the nasopharynx. Hypertrophy of the posterior tips of the turbinates sufficient to interfere with or retard this drainage causes a damming up of the secretions and this sets up the vicious circle of consequent congestion of the tissues, further disturbance of ciliary function and further interference with drainage (It is known that, in response to chronic irritation, large numbers of goblet cells make their appearance in the nasal mucosa, and it has been demonstrated in rabbits that this histopathological change can be produced by the mere mechanical plugging of the nose) The retained secretions become an excellent culture medium for the growth of organisms which would otherwise be removed, and the ground is laid for eventual purulent sinusitis

There is surely little argument about the advisability of correcting that type of nasal septum deviation which by impingement interferes with the proper aeration of or drainage from a sinus or sinuses, and surely surgical treatment of sinus disease in such a case, without attention to such a septum deviation, would be considered inadequate Why, then, does not the same fundamental principle apply to obstructive posterior tip hypertrophy — particularly as it can, and often carcely be overlooked, but that which is not visible by anterior rhinoscopy — and which is found to be strikingly pronounced when viewed with the nasopharyngoscope—can be, and all too often is overlooked and receives no attention This implies the importance — indeed, the necessity of including inspection with the nasopharyngoscope in every routine examination of the nose If this is omitted, much valuable diagnostic information relative to the posterior part of the nose and the nasopharynx will be precluded

The posterior tip hypertrophy or hyperplasia has been variously explained in the past One popular notion holds that it results from the insult of purulent or mucopurulent drainage from diseased sinuses, ergo, that it does not occur without pre-existent sinus disease This has been one of the factors leading to much of what most of us will agree has been poorly indicated, superfluous and unnecessarily radical sinus surgery in the past, and who can number the individuals who, after such surgery, continue to have excessive postnasal discharge as a result of the neglect of the posterior tip enlargement?

It occurred to me some years since that perhaps in many of these cases the cart and the horse had been interchanged, and that actually the purulent sinusitis was an end-result of a series of phenomena instituted by the hypertrophy of the posterior tips — and that it might be reversible

This reasoning was prompted by the very many examples of postnasal drainage persisting after sinus surgery, which ceased when the neglected posterior tip hypertrophy had been adequately treated It was supported by the very many examples of postnasal drainage which ceased without surgery, when the same treatment was used

The further consideration and more careful examination of the posterior portion of the turbinates was rewarded, as I observed the consistency not only with which they were found to be hypertrophied in these cases, but also with which the postnasal discharge decreased and ultimately stopped as they were treated All of this is even more striking when the symptoms and findings are unilateral — as has been the case repeatedly

In many instances, X-ray evidence of sphenoethmoidal sinusitis has disappeared after the return to normal of the turbinal tips, with no treatment other than that directed to their hypertrophy In other cases of purulent sphenoethmoiditis, treatment of the posterior sinuses, including the Proetz displacement therapy, has been effective only after the enlargement of the turbinate tips has resolved under local treatment, furthermore, maxillary sinusitis, which is certainly frequently merely a further extension of sphenoethmoiditis, has likewise repeatedly cleared, not from local treatment to the antrum but only when attention has been given to the turbinate tips

There need be no wonder at these observations if the fundamental physiology of the nose and accessory sinuses is kept in mind The two requisites for normal physiological function of this area are aeration and drainage Normal drainage resulting from ciliary action is toward the nasopharynx Hypertrophy of the posterior tips of the turbinates sufficient to interfere with or retard this drainage causes a damming up of the secretions and this sets up the vicious circle of consequent congestion of the tissues, further disturbance of ciliary function and further interference with drainage (It is known that, in response to chronic irritation, large numbers of goblet cells make their appearance in the nasal mucosa, and it has been demonstrated in rabbits that this histopathological change can be produced by the mere mechanical plugging of the nose) The retained secretions become an excellent culture medium for the growth of organisms which would otherwise be removed, and the ground is laid for eventual purulent sinusitis

There is surely little argument about the advisability of correcting that type of nasal septum deviation which by impingement interferes with the proper aeration of or drainage from a sinus or sinuses, and surely surgical treatment of sinus disease in such a case, without attention to such a septum deviation, would be considered inadequate Why, then, does not the same fundamental principle apply to obstructive posterior tip hypertrophy — particularly as it can, and often scarcely be overlooked, but that which is not visible by anterior rhinoscopy — and which is found to be strikingly pronounced when viewed with the nasopharyngoscope—can be, and all too often is overlooked and receives no attention This implies the importance — indeed, the necessity of including inspection with the nasopharyngoscope in every routine examination of the nose If this is omitted, much valuable diagnostic information relative to the posterior part of the nose and the nasopharynx will be precluded

The posterior tip hypertrophy or hyperplasia has been variously explained in the past One popular notion holds that it results from the insult of purulent or mucopurulent drainage from diseased sinuses, ergo, that it does not occur without pre-existent sinus disease This has been one of the factors leading to much of what most of us will agree has been poorly indicated, superfluous and unnecessarily radical sinus surgery in the past, and who can number the individuals who, after such surgery, continue to have excessive postnasal discharge as a result of the neglect of the posterior tip enlargement?

It occurred to me some years since that perhaps in many of these cases the cart and the horse had been interchanged, and that actually the purulent sinusitis was an end-result of a series of phenomena instituted by the hypertrophy of the posterior tips — and that it might be reversible

This reasoning was prompted by the very many examples of postnasal drainage persisting after sinus surgery, which ceased when the neglected posterior tip hypertrophy had been adequately treated It was supported by the very many examples of postnasal drainage which ceased without surgery, when the same treatment was used

The further consideration and more careful examination of the posterior portion of the turbinates was rewarded, as I observed the consistency not only with which they were found to be hypertrophied in these cases, but also with which the postnasal discharge decreased and ultimately stopped as they were treated All of this is even more striking when the symptoms and findings are unilateral — as has been the case repeatedly

In many instances X-ray evidence of sphenoethmoidal sinusitis has disappeared after the return to normal of the turbinal tips, with no treatment other than that directed to their hypertrophy In other cases of purulent sphenoethmoiditis treatment of the posterior sinuses, including the Proetz displacement therapy, has been effective only after the enlargement of the turbinate tips has resolved under local treatment furthermore maxillary sinusitis which is certainly frequently merely a further extension of sphenoethmoiditis has likewise repeatedly cleared, not from local treatment to the antrum but only when attention has been given to the turbinate tips

There need be no wonder at these observations if the fundamental physiology of the nose and accessory sinuses is kept in mind. The two requisites for normal physiological function of this area are aeration and drainage Normal drainage resulting from ciliary action is toward the nasopharynx Hypertrophy of the posterior tips of the turbinates sufficient to interfere with or retard this drainage causes a damming up of the secretions and this sets up the vicious circle of consequent congestion of the tissues, further disturbance of ciliary function and further interference with drainage (It is known that, in response to chronic irritation large numbers of goblet cells make their appearance in the nasal mucosa and it has been demonstrated in rabbits that this histopathological change can be produced by the mere mechanical plugging of the nose) The retained secretions become an excellent culture medium for the growth of organisms which would otherwise be removed and the ground is laid for eventual purulent sinusitis

There is surely little argument about the advisability of correcting that type of nasal septum deviation which by impingement interferes with the proper aeration of or drainage from a sinus or sinuses, and surely surgical treatment of sinus disease in such a case, without attention to such a septum deviation, would be considered inadequate Why, then, does not the same fundamental principle apply to obstructive posterior tip hypertrophy — particularly as it can and often does, interfere with the normal physiological function of *all* of the sinuses? Admittedly, ultraconservatism can, on occasion, be a radical form of treatment, but increasing attention to those therapeutic procedures which lead to a restoration of normal nasal physiology, in preference to mutilating surgery, will give to the next generation of rhinologists far fewer nasal cripples, such as we have inherited as discouraging monuments to the past era of radicalism

It is difficult to determine a single cause of all posterior tip hypertrophy Undoubtedly, some are caused by lack of attention to the sphenoethmoidal region during and following an ordinary upper respiratory infection (How often do we learn from a patient that his postnasal discharge commenced after a head cold or an attack of influenza!) In many instances, however, the hypertrophy develops gradually due to passive congestion of the region as a result of posture This accounts for the instances of unilateral changes in the patients who sleep on one side We are all familiar with the statement "My nose blocks at night, the right nostril if I lie on my right side, the left nostril if I lie on my left side"

Once the hypertrophy attains a certain degree, the aforementioned vicious circle is established, and it must be interrupted if the patient is to have relief

In the stage preceding the development of purulent sinusitis, there may be for months or years persistent, regular, excessive postnasal discharge, with each day initiated by an hour or so of "hawking" and spitting, often accompanied by gagging and vomiting Eventually, the mesopharynx and hyperpharynx present islands and bands of lymphoid hyperplasia These patients complain of a continued sense of irritation in the throat and often of pain, and they are subject to repeated attacks of acute nasopharyngitis as a result of the chronically irritated pharynx plus the fact that the inspired air is funneled and concentrated, instead of being normally disseminated Because of this, they are subjected to various forms of local treatment of the pharynx, but not until treatment is directed to the posterior tip hypertrophy do they ordinarily obtain lasting relief

At this stage, no evidence of sinus disease can be found, and inspection with the nasopharyngoscope, after thorough nasal shrinkage, reveals the nasal passages and meati to be normal, but at the posterior end of the inferior turbinate there is a berry-like, relaxed, pendulous mass, often polypoid in appearance It is frequently surrounded by a pool of thick viscous mucus, which may extend to and overlie the Eustachian tube orifice Many times an edematous thickening is seen to extend up the lateral wall from the inferior to the middle turbinate, with enlargement also of its posterior tip

Thus we understand the additional symptoms often present, namely, those of Eustachian salpingitis — intractable to inflation —and those of pain of sphenopalatine ganglion distribution How often has it been possible — and how gratifying — to witness the complete cessation of such symptoms of months' or years' duration following the conservative treatment of the hypertrophied region — and nothing else!

How, then, shall we treat this hypertrophy of the posterior tips? Their surgical removal has had considerably fewer advocates as detailed knowledge of normal nasal physiology has increased We do not wish to sacrifice any normal nasal membrane, and we certainly wish to avoid the crusting that has all too often in the past followed surgery in this area, particularly if part of the turbinate bone has been removed, but a manner of therapy is available which has none of these disadvantages of surgery, and which is, furthermore, bloodless and painless It is phenolization of the hypertrophied tissue

I have heard objections to this method of treatment in the past, and I shall hear them again — but not from the patients! The objections voiced by the physicians have invariably proved to be on the basis of a misunderstanding of what is being attempted, or of faulty technique

The usual criticism, of course, is that ciliated mucosa is being destroyed Obviously, it is our desire and aim to destroy that portion of the posterior aspect of the turbinate which remains enlarged when the rest of the nasal tissues are shrunken, and, if the technique of the treatment is proper, no more than this unwanted tissue is affected does, interfere with the normal physiological function of *all* of the sinuses? Admittedly, ultraconservatism can, on occasion, be a radical form of treatment, but increasing attention to those therapeutic procedures which lead to a restoration of normal nasal physiology, in preference to mutilating surgery, will give to the next generation of rhinologists far fewer nasal cripples, such as we have inherited as discouraging monuments to the past era of radicalism

It is difficult to determine a single cause of all posterior tip hypertrophy Undoubtedly, some are caused by lack of attention to the sphenoethmoidal region during and following an ordinary upper respiratory infection (How often do we learn from a patient that his postnasal discharge commenced after a head cold or an attack of influenza!) In many instances, however, the hypertrophy develops gradually due to passive congestion of the region as a result of posture This accounts for the instances of unilateral changes in the patients who sleep on one side We are all familiar with the statement "My nose blocks at night, the right nostril if I lie on my right side, the left nostril if I lie on my left side"

Once the hypertrophy attains a certain degree, the aforementioned vicious circle is established, and it must be interrupted if the patient is to have relief

In the stage preceding the development of purulent sinusitis, there may be for months or years persistent, regular, excessive postnasal discharge, with each day initiated by an hour or so of "hawking" and spitting, often accompanied by gagging and vomiting Eventually, the mesopharynx and hyperpharynx present islands and bands of lymphoid hyperplasia These patients complain of a continued sense of irritation in the throat and often of pain, and they are subject to repeated attacks of acute nasopharyngitis as a result of the chronically irritated pharynx plus the fact that the inspired air is funneled and concentrated, instead of being normally disseminated Because of this, they are subjected to various forms of local treatment of the pharynx, but not until treatment is directed to the posterior tip hypertrophy do they ordinarily obtain lasting relief

At this stage, no evidence of sinus disease can be found, and inspection with the nasopharyngoscope, after thorough nasal shrinkage, reveals the nasal passages and meati to be normal, but at the posterior end of the inferior turbinate there is a berry-like, relaxed, pendulous mass, often polypoid in appearance It is frequently surrounded by a pool of thick viscous mucus, which may extend to and overlie the Eustachian tube orifice Many times an edematous thickening is seen to extend up the lateral wall from the inferior to the middle turbinate, with enlargement also of its posterior tip

Thus we understand the additional symptoms often present, namely, those of Eustachian salpingitis — intractable to inflation —and those of pain of sphenopalatine ganglion distribution How often has it been possible — and how gratifying — to witness the complete cessation of such symptoms of months' or years' duration following the conservative treatment of the hypertrophied region — and nothing else!

How, then, shall we treat this hypertrophy of the posterior tips? Their surgical removal has had considerably fewer advocates as detailed knowledge of normal nasal physiology has increased We do not wish to sacrifice any normal nasal membrane, and we certainly wish to avoid the crusting that has all too often in the past followed surgery in this area, particularly if part of the turbinate bone has been removed, but a manner of therapy is available which has none of these disadvantages of surgery, and which is, furthermore, bloodless and painless It is phenolization of the hypertrophied tissue

I have heard objections to this method of treatment in the past, and I shall hear them again — but not from the patients! The objections voiced by the physicians have invariably proved to be on the basis of a misunderstanding of what is being attempted, or of faulty technique

The usual criticism, of course, is that ciliated mucosa is being destroyed Obviously, it is our desire and aim to destroy that portion of the posterior aspect of the turbinate which remains enlarged when the rest of the nasal tissues are shrunken, and, if the technique of the treatment is proper, no more than this unwanted tissue is affected

A thin, light, malleable piano-wire type of applicator is used for the anesthetizing agent, and it is wrapped very lightly, the cotton then being compressed so that it is flat when applied Very little cotton is used, so that when it is wrapped on the applicator it is no thicker than paper, and is half the size of one's little fingernail

First, the nose is sprayed with a 2 per cent solution of cocaine-hydrochloride Then the cotton applicator described above, moistened with a 20 per cent solution of the same drug, and bent to conform to the nose being treated, is placed so that the cotton is in contact with the turbinate tip and left there for 10 minutes This ordinarily affords adequate analgesia for phenolization Actually the phenol anesthetizes the tissue in 10 seconds, as can readily be demonstrated

For the application of the phenol, the amount of cotton on the end of the same applicator is scarcely the size of the head of an ordinary pin To avoid contact with any normal nasal tissue, the applicator bearing the phenol is usually introduced parallel to the floor of the nose, and is turned laterally to reach the posterior tip of the turbinate when it reaches the proper depth

The application of the chemical is precise and "to the point", and the course of the treatment can be checked accurately at any time with the aid of the nasopharyngoscope Although the number of treatments varies with the degree of the hypertrophy, it is striking to note how frequently marked symptomatic relief is reported after the first or second treatment, even though the symptoms have been present for years

Ordinarily there is no reaction to the treatment, but should it occur, it is nothing more than a temporary accentuation of the pre-existent symptoms Phenolization of a given area is ordinarily not repeated at intervals of less than a week

One's impulse, all too often, is to end the applications of phenol when the subjective symptoms have ceased, but they should be continued until nasopharyngoscopic inspection proves that the hypertrophy has been entirely eradicated, otherwise there will be an eventual return of the symptoms, discouraging both to the patient and to the doctor When the required course of treatment, varying with the case, has been completed, it is well to advise the patient of the importance of attending to any future head cold which does not clear completely in a few days

How does the phenol act on the hypertrophy? After 11 years of using this procedure, and from clinical observation, and careful visual inspection, I was convinced that not only was there no deleterious action on the nose, but that, on the contrary, the entire nasal economy was improved, evidenced by lessened congestion of the membranes, freer nasal passages and clear sinuses It seemed advisable to determine what actually occurred in the tissue and to examine the end-result histologically, therefore, biopsy specimens were removed from hypertrophied posterior tips of inferior turbinates, using a small sharp-edged biting forceps Such specimens were taken before any treatment was instituted, 15 minutes after, one hour after, 48 hours after, and one week after phenolization (in this case the third application), and in one case a week after the ninth treatment, when the turbinate appeared normal, the patient's symptoms were entirely relieved, and she was dismissed

The specimens were placed in formalin immediately after removal and within a few hours were blocked and sectioned for microscopic study

In a section of tissue removed from a hypertrophied posterior tip of the inferior turbinate before any treatment, the epithelium shows some desquamation and erosion There were numerous goblet cells The basal membrane varied considerably in thickness and was infiltrated with lymphocytes, which extend into the stroma The stroma presented marked edema, and contained many prominent, dilated, congested vascular spaces The glands were in a state of hypersecretion

Fifteen mintues after treatment with phenol the section was the same except for the appearance of a few polymorphs, in addition to an apparent increase in small round cells

One hour after phenolization the section shows a marked increase in inflammatory cells, which pack the vascular spaces (which are much smaller) and invade the basal membrane and the stroma. Most of the epithelium is markedly thinned.

A section of tissue removed two days after phenolization shows a transitional epithelial covering varying in thickness and without goblet cells. The edema is somewhat less, the vascular spaces smaller, and there are many lymphocytes and a few plasma cells and large mononuclear cells.

A section of tissue removed from a turbinate which had been treated three times with phenol, and was taken one week after the third treatment. The surface epithelium is distinct and contains many goblet cells. The stroma shows still less edema, and the lymphocytic infiltrate, particularly in the deeper portion, is less marked. The cavernous spaces and glands are prominent.

A section of tissue from the turbinate which had been phenolized nine times, and was taken a week after the ninth teatment bears stratified columnar ciliated epithelium with a normal content of goblet cells. The basal membrane is normal in appearance. The stroma is dense and practically free of edema, the cellular infiltrate is mild, and the vascular spaces and glands have a normal appearance.

It is my opinion that this last section is the complete answer to those who have feared that the form of treatment has a harmful effect on the tissue concerned. It is worth mentioning that I also removed a bit of tissue from a turbinate which had had 14(!) applications of phenol, and the pathologist's report states, "surface epithelium seems quite normal and is well preserved."

From this study, it seems that as a result of phenolization the surface membrane shows intermediate alteration, as would be expected, but the final state shows no discernible deviation from normal. This corresponds with my clinical observations of these cases over the past 11 years, for they never develop crusting or other evidence of perverted surface membrane physiology.

SUMMARY

Further attention has been directed to a simple and conservative treatment of a too-frequently neglected area of the nose, which is a most common cause of postnasal discharge, altered nasal physiology and sinusitis It has been observed clinically in thousands of cases, and it has now been proved microscopically that phenolization of obstructive hypertrophy, when meticulously performed, has no deleterious effect The relief of symptoms following this treatment is striking, the gratitude of the patients is touching, and one's conscience is free of the onus of having performed unnecessary sinus surgery and perhaps of adding to the number of nasal cripples extant, which is already too great

---

STATE UNIVERSITY OF IOWA COURSE IN CLINICAL AUDIOMETRY

An intensive two weeks' course in Clinical Audiometry will be offered at the State University of Iowa, June 14 to 28, 1949 The course will be conducted daily from 8 00 to 5 00 and will include lectures on audiometry, lip-reading, speech training for the hard of hearing, psychological problems of the acoustically handicapped and clinical otolaryngology, laboratory work, including observation and participating in hearing testing and hearing aid fittings for clinical patients in the Department of Otolaryngology and Oral Surgery, State University of Iowa Hospital, observation of the university's comprehensive speech pathology program, and special pictures and demonstrations by Prof John S Steinberg, of the Bell Telephone Laboratories, and Mrs Bernice Rutherford, of the Rehabilitation Center, St Paul, Minn

One of the Iowa Hearing Clinics, involving medical, psychological, speech, audiometric and social work approaches to cases assembled by the Department of Otolaryngology and Oral Surgery, the Iowa State School for the Deaf, and the Speech Clinic will be scheduled during the intensive course

For further information address Prof Wendell Johnson, Director, Speech Clinic, State University of Iowa, Iowa City, Iowa

THE INCIDENCE (AND DEGREES) OF BLUE SCLERAS IN OTOSCLEROSIS AND OTHER EAR DISORDERS *

EDMUND PRINCE FOWLER, M D ,
New York, N Y

Attention was called to blue scleras over 100 years ago,[1] and multiple fractures were sometimes noted in connection therewith Later it was demonstrated that these fractures were occasioned by osteogenesis imperfecta (fragile bones) which histologically shows a resemblance to immature or embryonic bone The combination of blue scleras with multiple fractures showed marked inheritance characteristics as a Mendelian dominant, and was frequently associated with a late progressive deafness (supposedly otosclerosis) No continuing effort was made to study the possibilities of these observations in relation to the etiology or progressiveness of otosclerosis or other osteo dystrophies

Eddows[2] found in four generations of a family that 50 per cent of the offspring of the heterozygotic parents had blue scleras and brittle bones, and that the unaffected offspring did not have affected descendants Only those with blue scleras had brittle bones, a generation was never skipped, and transmission was not through females to males Bronson[3] reported a study of two families In one (four generations), 95 per cent of those with blue scleras suffered multiple fractures and 33 per cent had deafness In the other (three generations), 70 per cent of those with blue scleras had fractures, and none had deafness

---

*Read at the meeting of the Eastern Section American Laryngological Rhinological and Otological Society Inc Boston Mass Jan 7 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication Jan 19 1949

Brickley[1] states that "only those members of a family who have blue scleras are subject to brittle bones and the deafness" Key,[4] in 1926, reviewed the literature, reported one case and concluded that the tissue abnormalities seemed to be due not to faulty metabolism but to a hypoplasia of the mesenchyme, *i e*, an anomaly of development Riesenman and Yater,[5] Corboy,[6] Farber and Margulis[7] and several others reported a series of patients and family groups with varying ratios of incidence With a few exceptions no significant abnormalities in the blood calcium or phosphorus were noted

Van der Hoeve[8] and then de Kleijn[9] and also Bronson,[3] in 1917, showed that a large proportion of cases developed an hereditary conduction deafness (otosclerosis) This deafness tended to develop in the third and fourth decades, and in *advanced cases a nerve deafness was generally superimposed* thereon The obstructive deafness, because of its late development, was not noticed or was not detectable early in life It appeared only long after the fracturing had ceased, so that even though the scleras were blue, the probability of having the triad brought to the attention of the examiner was remote In a few instances Rutkin and others histologically demonstrated otosclerosis to be present in varying degrees, and X-rays of the petrous bone have been reported to show dense shadows, especially in the region of the vestibule Shambaugh, in a personal communication to Brickley, reported operating upon two patients with otosclerosis and blue scleras, one with multiple fractures and the other with a daughter with multiple fractures He found the mastoid cell walls "unusually delicate (thin) and brittle"[1] By Roentgenogram my own observations reveal that the mastoid cell walls in otosclerosis are usually thick I have encountered only a few patients with the complete "Van der Hoeve-de Kleijn triad," but have under observation a pair of seven and one-half year old identical twins with blue sclera and fragile bones but without deafness The parents have white scleras and normal hearing In several instances the otological diagnosis "otosclerosis" in the cases reported in the literature with blue scleras and brittle bones may be questioned, however, this does not qualitative alter the importance of the observations.

It is stated by Corboy[6] that about 60 per cent of the people with blue scleras suffer multiple fractures, 60 per cent have otosclerosis, and 44 per cent the complete triad. The fractures are not spontaneous, and because of the slight trauma usually involved give no great pain and show no delay in healing and tend to decrease after puberty. I infer that in such statistics reference is only to deeply blue scleras and to families with the triad, because I have observed several thousands of patients with scleras of all degrees of blueness with few multiple fractures, and many with no sign or symptom except the blue scleras to suggest the possibility of otosclerosis.

It is after puberty that the incidence and activity of the otosclerosis lesions, and the deafness therefrom, usually markedly increases, but after puberty the incidence of the fractures decreases, so that it would seem improbable that one would often observe all three of the signs of the triad simultaneously.

The sclera occupies the posterior five-sixths of the eyeball, the cornea the anterior one-sixth. In different people blue scleras may be various shades of muddy, slate, gray, clear or sky blue. In every instance I have observed the blueness to be deeper in hue in the anterior third of the sclera, and in the lesser degrees blue only in this area, the posterior third then being white. To avoid possible bias, the color of the sclera should be determined and recorded before taking the family or personal history, or making the otological examination.

The blueness is best revealed when the eye is looking downward. Some sclera appear to be clear white when the eyes are looking straight to the front, and bluish over the superior segment over the uvea when looking downward, or to the right or left. These sclera are usually marked questionable. Designating the white sclera as 0, the successive degrees of blueness are designated 1, 2, 3 and 4 plus. These are written on the history sheet as 0, +, ++, +++, ++++) If there is any question as to the sclera being blue or white, it is so indicated by the question mark "?". An attempt was made to use a color scale to determine by comparison [illegible] the degrees of blueness, but it was found quicker and more satisfactory to dispense with it, because we could not reproduce on the scale all of the variations of blue encountered. The eyes were examined first in daylight and then by a daylight lamp.

Blue scleras are common in humans, but uncommon in the lower animals. They are associated with several disease conditions involving the mesenchyme. As far as I have been able to ascertain, blue scleras when they do occur in animals are not associated with brittle bones; however, inquiries of several of the investigators reveal that animals do not have brittle bones. It is more natural to believe that if they did they would be ill equipped for life and destroyed early.

The cause of blue scleras is unknown. Some think the blueness of the sclera is due to a thinning or lessening in density of the sclera tissues so that the blue of the choroid or uvea becomes visible. I have observed the blueness to change from blue to white, but in individuals I have never observed it to disappear permanently. In a few instances an increase in blueness with a coincidental increase in the deafness has been observed with the years.

The blueness of the sclera is definitely influenced by one's general physical state, and anything which affects the general health. Temporary increases in blueness are common. This suggests that the capillary bed plays an important role, and [illegible] with certain [illegible] and [illegible] and therefore with changes in metabolism [illegible] and with [illegible] and [illegible]. These [illegible] excite our imagination and [illegible] the phenomena.

The [illegible] the incidence and degree of blueness of the sclera in [illegible] patients recently examined. The patients [illegible]

TABLE 1

INCIDENCE OF BLUE SCLERAS IN DISORDERS OF THE EARS

Diagnosis	White Scleras			Blue Scleras			(White Patients)		
	0	?					Totals		%
	M 63	1	4	0	0		68	M	6%
	F 69	4	6	3	3		85	F	14%
	132	5	10	3	3		153		
Normal	87%	3%	6%	2%	2%				10%
	M 79	4	8	2	0		93	M	11%
	F 68	15	9	9	3		104	F	20%
	147	19	17	11	3		197		
Nerve	74%	10%	9%	5½%	1½%				16%
	M 45	1	5	2	1		54	M	14%
	F 65	11	11	13	1		101	F	25%
	110	12	16	15	2		155		
Otitis Media	71%	8%	10%	9½%	1½%				21%
	M 5	2	2	3	1	1	14	M	50%
	F 9	3	12	19	3	3	49	F	75%
	14	5	14	22	4	4	63		
Otosclerosis	24%	7%	22%	35%	6%	6%			69%
Totals	403	41	57	51	12	4	568		

divided into four categories normal, nerve, otitis media* and otosclerosis As in any attempt to place disease into clear-cut categories, some overlapping occurs, but for our present purpose this is of no special importance

In studying the data one should keep in mind that probably under every category but the last (otosclerosis), as in the white population at large, 8 to 10 per cent harbored otosclerosis, although it was not diagnosable when the patient was examined, and also that the otosclerosis lesions may have been either active or inactive at the time of our examination If any of this 8 to 10 per cent have a hidden otosclerosis, and blue scleras, as it seems reasonable to infer they have, and they were added to the otosclerosis cases it would increase the number of otosclerosis cases and the percentage of blue scleras in otosclerosis, and diminish both in the normals and in the other categories

In several instances patients with blue scleras diagnosed as questionably otosclerotic several years ago have returned with the typical progressive deafness of otosclerosis (some were siblings) If these were added to the tabulated otosclerosis cases the incidence of the blue scleras in otosclerosis would be considerably increased When some of these patients were seen originally their losses of hearing were only 5 to 20 db in any part of the frequency scale, there was no definite family history of otosclerosis and their personal history had been typical of slight middle ear inflammations, and, therefore, I could make only a questionable diagnosis of otosclerosis It is extremely risky to let unproved positive or negative tests or signs influence one's judgment in diagnosis, but it does no harm and may be of value, if we routinely look for and record them for future reference There are exceptions to many of the most widely accepted positive and negative diagnostic criteria

The normal hearing controls, as they showed no deafness, must have possessed some and probably a definite defense earlier and advances more rapidly in women than in men, so that we see many more young women than young men with otosclerosis I have elsewhere explained how this may happen[11] In this connection it should be pointed out that in Guild's data between the ages of 30 and 50 the ratido of males to females with otosclerosis is one to two, but before 30 it is one to three or more, the same as we observe it clinically It may be, and it is my impression, that the young women are more prone to consult the otologist early than are the young men, at any rate in every category in the table the female patients outnumbered the males

---

*Those with evidence of nonsuppurative or suppurative inflammatory episodes in the past or present with or without a history of same

Assuming that in my own as in your patients we examine a fair sample of the white population (with and without deafness), it would be logical to expect that if more women than men suffer from otosclerosis we will see more women than men in our offices, and by and large these women and men will harbor otosclerosis in about the same ratio as it occurs in women and men in the general population, but we do not see a fair sample, we see a larger proportion of people with deafness and a considerable portion of this deafness is due to otosclerosis At any rate this is the way it seems to me

It should be especially noted that the incidence of otosclerosis increased noticeably with the overall intensities of the blueness of the scleras, 3 per cent of the white scleras, 12 per cent of the questionably blue scleras, 35 per cent of the total number of blue scleras, 45 per cent of the two, three and four plus blue scleras, 50 percent of the three and four plus blue scleras, and 100 per cent of the people with four plus blue scleras were definitely diagnosed "otosclerotics"

These findings are what should be expected if there is a definite relationship between blue scleras and otosclerosis

In every category the incidence of blue scleras was higher in the females than in the males, and with the exception of otosclerosis it was about twice as great in the females as in the males In otosclerosis the ratio was three to two If there is some etiologic factor common to blue scleras and otosclerosis, these ratios are what should have been expected If they had not obtained, it would have mitigated against any close relationship between the two Contrawise, because of the rare occurrence of brittle bones in otosclerosis we may infer that there may be no close inter-relationship between the factors underlying otosclerosis and osteogeneses imperfecta Not until a large number of cases of the latter are available for study will it be possible to determine whether the incidence of otosclerosis in osteogenesis imperfecta is greater than in the blue sclera population at large, although the incidence of blue scleras appears to be high in both conditions

SUMMARY AND CONCLUSIONS

A brief reveiew and discussion of the literature has been set forth Five hundred sixty-eight patients first examined as to the bluess of their sclera, and then otologically, are tabulated in four categories (normal, nerve, otitis media and otosclerosis), and under six degrees of blueness of the scleras

The incidence of blue scleras in those with otosclerosis is 69 per cent, as compared with 10 per cent in normal hearing controls, 16 per cent in nerves, and 21 per cent in otitis media deafness These percentages and the ratios of males to females are discussed and several significant agreements and disagreements with clinical and autopsy findings are pointed out

Otosclerosis was diagnosed in 3 per cent of those with white scleras, 12 per cent of those with questionably blue, 35 per cent of those with two or more degree of blueness, in 50 per cent of those with three or more degrees of blueness, and in 100 per cent of those with four degrees of blueness of the sclera

These, and the other findings, coincide so closely with what should be expected if there is a definite relationship between blue scleras and otosclerosis that they should not be ignored A larger sampling and continuing studies will determine more clearly (especially in families with a positive history of otosclerosis) the importance of the color of the sclera for etiological investigations, and for a preclinical or prognostic diagnosis of otosclerosis, and above all let us hope for preventive treatment

BIBLIOGRAPHY

1 BRICKLEY, DANIEL W, JR Otoclerosis and Blue Scleras *Arch Otolaryngol*, 46 2 230 236, Aug, 1947

2 EDDOWS, R *Brit Med Jour*, 2 222, 1900

3 BRONSON, E *Edinburgh Med Jour*, 18 240 281 Apr, 1917

4 KEY, J A Brittle Bones and Blue Sclera Hereditary Hypoplasia of the Mesenchyme *Arch Surg*, 13 523 567, Oct, 1926

5 RIESENMAN, F R and YATER, W M Osteogenesis Imperfecta Its Incidence and Manifestations in Seven Families *Arch Int Med*, 67 950 967, May 1941

6 CORBOY, P M *Amer Jour Ophth*, 24 57 80, Jan, 1941

7 FARBER, J E, and MARGULIS, A E Blue Scleras, Brittle Bones and Deafness Report of Afflicted Family *Arch Int Med*, 71 658 665, May, 1943

8 and 9 (A) and (B) Cited by Key[4]

10 GUILD, STACY R Histologic Otosclerosis *Ann Otol, Rhinol and Laryngol*, 53 2, June, 1944

11 FOWLER E P SR Estrogens, Bone Metabolism and Otosclerosis *Arch Otolaryngol* (in press)

140 East 54th Street

THE FUTURE OF OUR SPECIALTY*

HOWARD MCCART, M.D.,
Toronto, Canada

I express my gratitude for the honor you have bestowed upon me, and ask your continued support of this Society. This can be accomplished in several ways, among which is active membership in your Society and your participation in the free discussion of the papers on the program. The success of any society depends on the enthusiasm of the Fellows and the conscientious effort of the officers to carry out your wishes. A large membership does not necessarily make for the success of a society, but I am of the opinion we should endeavor to expand the membership of the Canadian Otolaryngological Society, providing each member is willing to play an active part. The late Dr. James Babbitt, in his presidential address before the Academy of Ophthalmology and Otolaryngology, stated that he was aware of two groups in our specialty—those within the Academy, and those without. To those without our Society, may I ask for your membership, which will be greatly advantageous to all of us in the everchanging days to come, by guarding majority rather than the individual rule? Your support of the Society may at times seem intangible, but by so doing, you can play your part in the broader field of Canadian medicine, thus assuming leadership in our specialty and assisting in the training of otolaryngologists in our country.

There has always been a close relationship between ophthalmology and otolaryngology. Many of our Fellows are mem-

---

*Presidential Address, Canadian Otolaryngological Society, Thousand Island Club, Alexandria Bay, N. Y., June 1948.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Nov. 20, 1948.

bers of the ten-year-old Canadian Ophthalmological Society As many of you practice both specialties, it is only fitting that a closer association should be fostered between the two societies

As the name of our specialty implies, it is Diseases of the Ear and Larynx, and includes Diseases of the Throat, Pharynx, Nose and Nasal Sinuses, Trachea, Bronchi and Esopahgus It is evident that this somewhat imposing array of diseases will not remain in our specialty permanently, unless we are prepared to broaden our knowledge and training

It is interesting to review briefly the history of otolaryngology We are young in many ways It was in 1839 that James Yearsley adopted otology as a specialty and founded the Metropolitan Ear Hospital in London, Wilde, about 1841, was the first to teach otology in the United Kingdom, the students coming from all over the world, especially America Hinton, in 1868, was probably the first surgeon in Britain to operate on mastoiditis, which is somewhat ironical, as at the present time, 80 years later, acute mastoid surgery is rare Meyer (1868), in Copenhagen, discovered adenoids Joseph Toynbee, the great pioneer otologist, placed otology on a sound basis he was the first to describe otosclerosis, mentioning a report of 160 cases in the year 1860 In 1859, only 89 years ago, Marshall Hall stated, in the *Lancet,* that we must regard tracheotomy as a heroic remedy only appropriate to Herculean forms of disease Sir Charles Ballance (1856-1936), another pioneer, was noted for his work on mastoiditis and facial paralysis, and lastly, Sir William McEwen (1848-1924), the results of whose operations for otogenic cerebral abscess are still remarkable

Previously, ophthalmology and otology were practiced together Laryngology came into being as a branch of general medicine rather than an offshoot of surgery, nor did it advance as a special branch of medicine until Garcia, in 1854, discovered the laryngeal mirror Morrell McKenzie (1837-1892) should be regarded as the founder of British laryngology Sir Patrick Heron Watson (1832-1907) performed the first laryngectomy, and Sir Felix Semon (1849-1921) was one of the last to practice laryngology as an independent specialty Early in the present century otology merged with laryngology to become otolaryngology

There are many of us who, for some years, have felt that there is something lacking in our specialty, that it has changed, that it is becoming narrower, perhaps it is that we, the specialists, have narrowed After World War I, many men without adequate training were attracted to ear, nose and throat practice, largely because of the trend in medicine to search for a focus of infection in all systemic diseases In many cases, and often at the request of the internist, possible foci were removed in arthritis, bronchitis, rheumatic fever, etc., and the results found wanting Today there is less unnecessary surgery, fewer sinuses punctured, fewer Eustachian tubes catheterized We have a better understanding of the nasal mucosa and its function, much of which can be credited to Proetz We have more respect for the nasal mucosa of an allergic patient, though we understand it less Perhaps, too, our knowledge or understanding of psychosomatic medicine has improved, thus recognizing that a patient's emotions may throw him off balance, affecting remote organs Wolff and his co-workers have shown reactions of emotional stress in relation to the mucous membrane of the nose, one in which shrinking of the nasal mucosa occurred, accompanied by the emotion of fear and sadness, and again initial hyperemia of turbinates, septum and nasal mucosa, with resultant nasal obstruction occurring with anger and feeling of frustration Thus emotional states may often require study in chronic sinusitis, vasomotor rhinitis and headache, or may be an underlying factor in the common cold Lastly, our specialty has changed or narrowed, due to chemotherapy and antibiotics

Recognizing these changes, we must improve on our predecessors' methods and intentions It is my belief that this is an opportune time for us as specialists to reflect and lay plans, rather than to wait until inroads are made in our specialty A recent inroad appears to be in bronchoscopy

Bronchoscopy in most centers has always been, and rightly so, a branch of otolaryngology Our weakness lay in that all of us did not include it in our specialty, due in some cases to lack of interest or the belief that there was not an opportunity to do this work in our centers — to those, I say that you would be surprised if you would attach yourself to sanatoria, with or without recompense This is one means of broadening your specialty As a result of this lack of interest in some centers, chest physicians and surgeons have recently undertaken this work I do not object to any physician or surgeon doing bronchoscopy, providing he is adequately trained, but then only in centers where ear, nose and throat service is not provided Nor is the medical or surgical problem always solved by bronchoscopy, but rather does the case need further clinial investigation Bronchoscopy is not a field for everyone The examination of a few cases will not enable one to become skillful or able to recognize the variety of conditions that may be encountered In larger centers, especially in university centers, it should be carried out by the department of otolaryngology, as it is only by such means that our future otolaryngologists can be trained in this work, or become deft in the removal of foreign bodies from the bronchi and esophagus, and become quickly familiar with the different diseases of these organs Otolaryngologists are more eminently suited for this work, as they are used to working in small fields and have developed monocular vision

Not too many years ago, otolaryngologists did thyroid surgery I do not see why this again should not be included in our specialty, also deep neck, meningeal and major plastic surgery Brain abscesses were formerly in the field of otolgy The modern otologist should have a working knowledge of neurology He should be competent to open a cerebellar abscess, either by the internal route, *i e*, mastoid, or by the external route It is only a step in surgical technique to perform block dissection on the glands of the neck, or to remove esophageal diverticula for one trained to perform major laryngeal surgery

More otolaryngologists must become qualified to deal with cancer of the larynx The surgical treatment over a period of years will show a high percentage of cures, especially in the intrinsic cases I also believe that unless the laryngologist is prepared to carry out the operation himself, he is better advised to let the operating surgeon do the biopsy, if not, it is often difficult for him to determine the extent of the lesion, especially if it is near one or the other commissure

How shall we best improve on our predecessors' methods and intentions, feeling that otolaryngology is perhaps at a crossroad? The present training for otolaryngologists in Canada consists of two years, including the basic sciences, preceded by a general intern year Thus we have established certain standards for training and defined them Some of you are of the opinion this time is too long and unnecessary This is not true, as surgery and its specialties, more than other divisions of medicine, demand intensive and prolonged training

Certification is a means of eliminating the self-styled specialist and giving a diploma to those successful in passing this examination I wonder if it would not be much better for our specialty to have a Fellowship examination, following the plan of surgery, obstetrics and gynecology, and genitourinary surgery

If such a plan was followed, a student contemplating the study of otolaryngology, upon completion of his general intern year, would be required to take one year of general surgery, then should follow a period of training of not less than two years in otolaryngology, during which time instruction in the basic sciences could be given within the medical school The added year in general surgery and basic sciences should greatly aid otolaryngologists to become more skillful surgeons, enabling them to try the Fellowship examination and to be competent to perform all surgery of the head and neck

The problem of the deaf is a serious health problem in Canada While no survey has been made in Canada, except in isolated districts, it would not be unfair to accept the figure of the United States, which is that 6 to 7 per cent of the population has a hearing impairment This Society should take concerted action regarding this problem and a committee circulation This gives rise to a state of portal or splenic hypertension In either case there occurs marked engorgement of the portal circulation owing to the inability of the splenic or portal vein to return the blood adequately to the systemic circulation

Nature tends to compensate for this difficulty and to establish new channels to return this stagnant blood to the general circulation This attempt as a rule generally takes place through the channels of communication that already exist between the portal and the systemic circulation The anastomosis that most frequently results and with which we are most concerned is that which leads to the development of the esophageal varices This anastomosis, as McIndoe has pointed out, is by way of the coronary vein, which likewise is the most direct means of communication between the portal and the systemic circulation The coronary vein of the stomach branches as it pierces the muscular coat to reach the submucosa of the cardia, where it divides into a number of small longitudinal medials which have no cross-communication for 3 or 4 cm At this level they break up into a rich plexus which anastomoses freely, and which may extend into the upper third of the esophagus The communicating branches run from the plexus to large periesophageal trunks which, in turn, communicate with the intercostal branches through the diaphragmatic vein to the systemic circulation The veins of the submucosa of the esophagus are very poorly supported by loose connective tissue

As a result, varices develop because the increased flow of blood through the veins and the inability of the muscular elastic fibres to withstand the increased venous pressure In addition, the tendency towards the formation of varicosities is accentuated by the effects of increased intrathoracic pressure

Esophageal varices, as seen through the esophagoscope, present a characteristic picture The varicoceles appear as tortuous, often nodular, light bluish prominences which protrude into the esophageal lumen, they are easily compressible and change shape with peristalsis of the esophagus They tend to run in a longitudinal plane and may be so large and numerous that they occupy the entire esophageal lumen

The diagnosis of the esophageal varices is too often made at the autopsy table One should be suspicious in any case where there is a history of unexplained massive gastrointestinal bleeding

Careful Roentgenological examination of the esophagus will usually reveal the presence of varices Occasionally the diagnosis can be made only by esophagoscopy

The purpose of injecting a sclerosing solution into the esophageal varices is to block the free passage of blood through the esophageal vein One hopes to stimulate a border circulation to increase its efficiency in conveying blood back through the liver to the systemic circulation in a normal manner, however, the more important reason is the stimulation of new anastomotic channels to convey the blood from the portal to the systemic circulation by such a route that the communication will not be subjected to trauma as occurs in the esophagus

Splenectomy, as we know, is the procedure which has given the most satisfactory results in cases in which the esophageal varices were due to splenic anemia Splenectomy alone will cure only that relatively small group of thrombosis of the splenic veins in which the site of obstruction is distal to the junction of the coronary veins Dr Will Mayo pointed out that this procedure should be of value if for no other reason than that the removal of the spleen decreases by 20 per cent the amount of blood that passes through the portal circulation In so doing, this lessens the amount of blood that must be transmitted back to the systemic circulation by the portal system Recurrence of hemorrhage subsequent to splenectomy is, however, not unusual The recurrence of hemorrhage from esophageal varices after splenectomy takes place in approximately 50 per cent of the cases

It becomes readily apparent, therefore, that any procedure that can prevent such bleeding is deserving of serious consideration In 1933, Pemberton and Walters each suggested formed from each province, presenting their views before their provincial minister of health, so that we can prevent and ameliorate hearing defects and rehabilitate those persons who have lost serviceable hearing

The care of the deaf must be attacked early in life and should be a conjoined program between the departments of health and education We must draw the government's attention to the fact that we can diagnose and identify those individuals who are hard of hearing, that we have in many cases adequate therapeutic measures for those that show promise of a favorable prognosis, and that they, the government, must provide the buildings, equipment and teachers to rehabilitate those individuals who require special education by remedial instruction in speech reading, voice correction and vocational guidance

In some provinces, facilities are available in a limited manner for rehabilitation of those without serviceable hearing These institutions, if or when they are located, need many teachers of speech reading Speech reading is absolutely essential for normal social relationship In obstructive deafness, hearing aids give a return of this normal relationship, but when progressive deafness reaches a profound state, unless the patient has received speech reading early, he has nothing to fall back on in order to maintain this social relationship These institutions should be located at university centers, as it is only at such centers that many of the very necessary affiliated departments such as speech, physiology, psychology, physics and otolaryngology are available

Leadership in medicine and our specialty is essential So far, in this country it has been allowed to develop freely and independently How long this freedom will continue is difficult to say The various health insurance schemes in force or contemplated may curtail this freedom It is only by strong leadership in our profession that the high quality of medical education and medical services can be maintained

If this leadership becomes weak, we leave a poor heritage for those who follow, attracting youth without the necessary culture or vision, with the inevitable result of lowering our standard of medical education and the relationship between the patient and the physician Our country was founded by pioneers seeking freedom, and of such stock the medical profession of the North American Continent rose to its present heights without governmental regulations I am not unmindful of the excellent work that can be done by governmental health departments — such as in the treatment of tuberculosis, mental hygiene, rehabilitation of the blind and, we hope before long, a modern institution for the deaf Many of these people are handicapped for life and need institutional care, the upkeep of which must be borne by the state Many, and perhaps all, would be better for individual physician care were it not due to the prohibitive cost, however, I fail to see how complete governmental control of all medicine can offer the patient a higher standard of medical service It might rise in a few outlying districts but, on the whole, would fall in due course, finally attracting the type of student with intellectual inertia, interested only in his personal social security

I do not feel that anyone here will hold any brief with me when I say that medical leadership today is on the North American Continent and, as members of such, we must take a broader part and accept greater responsibility in postgraduate education of our Canadian otolaryngologists This leadership became necessarily more pronounced at the conclusion of the late war Canadian postgraduate teaching now has to rely on our own universities and teaching hospitals for leadership and instruction, because at the end of the war, many of our graduates were unable to pursue their postgraduate study, which had formerly been taken in Great Britain and the United States, as these countries were faced with a return to civilian life of a large number of their physicians seeking postgraduate instruction

This places a heavy and extra burden in many instances on the university and hospital staffs, but not without its reward, as I feel certain the efficiency of a staff will improve when they have to be responsible for the fundamental training in a specialty Such being the case, this Society should appoint a committee on otolaryngological teaching in Canada, so that we may rate our universities and hospitals, rather than be dependent upon the classification placed by the Rockefeller Foundation If such a committee is formed from this Society, I feel you will more likely have an aggressive Society Failing this, no matter how lofty the ideals of a Society may be, and our ideals are laid down in our constitution, we will soon become a Society where nothing is accomplished except the presentation of papers, we will be short lived or, even worse, develop or be governed by a clique

We, in Canada, should feel fortunate that we can accept the responsibility of postgraduate teaching in otolaryngology, fortunate that none of our great teaching institutions were damaged in the recent world conflict Travel and education previous to the last war helped many of our physicians and surgeons to consolidate the best teaching from abroad and at home May the Canadian profession continue by tradition to automatically pick out the best from our conservative British forefathers and the best from the advanced ideas of our neighbors to the south

I believe in the future of otolaryngology and have drawn to your attention some of the points necessary to insure the continuation of a sound and broad specialty This can be brought about only by increasing our general surgical training in order that we may be competent to carry out surgery of the head and neck Leadership must come through this Society if otolaryngology as a specialty is to hold its rightful place in the practice of medicine Let the Fellows of the Society break the bonds of narrow satisfaction, courageously attacking our responsibilities with wisdom and foresight, so that we may become broader medical men and better surgeons

ESOPHAGEAL VARICES AND THEIR TREATMENT BY INJECTION *

JOHN F TOLAN, M D ,
Seattle, Wash

The treatment of esophageal varices by injection of a sclerosing solution into the veins through an esophagoscope has been a source of considerable interest to esophagologists The first real work in this field carried out in this country was done by Dr Herman Moersch, of the Mayo Clinic My interest in this particular procedure was not only stimulated by his apparent success but also by several tragic experiences which he had at our clinic, caused by varices of the esophagus

In order to better understand the rationale for treating varices in the esophagus by injection of sclerosing solution it is advisable to review briefly some of the mechanisms involved in their production The etiology underlying the development of esophageal varices is not entirely known There are two theories generally advanced to account for their development first, those who have expressed the opinion that the primary difficulty is caused by disturbance of the vascular regulatory apparatus of the spleen so that the arterial blood flows unobstructed into the venous system and produces a tract analogous to that of an arterial venous fistula On the other hand, there are those who postulate that the difficulty arises as a result of obstruction in the splenic or portal vein owing to either intrinsic or extrinsic causes, producing an obstruction to the free passage of blood back to the systemic

---

*Read at the meeting of the Western Section American Laryngological Rhinological and Otological Society Inc. Los Angles Calif Jan. 29 1949

Editor's Note This ms. received in Laryngoscope Office and accepted for publication Feb 9 1949

circulation This gives rise to a state of portal or splenic hypertension In either case there occurs marked engorgement of the portal circulation owing to the inability of the splenic or portal vein to return the blood adequately to the systemic circulation

Nature tends to compensate for this difficulty and to establish new channels to return this stagnant blood to the general circulation This attempt as a rule generally takes place through the channels of communication that already exist between the portal and the systemic circulation The anastomosis that most frequently results and with which we are most concerned is that which leads to the development of the esophageal varices This anastomosis, as McIndoe has pointed out, is by way of the coronary vein, which likewise is the most direct means of communication between the portal and the systemic circulation The coronary vein of the stomach branches as it pierces the muscular coat to reach the submucosa of the cardia, where it divides into a number of small longitudinal medials which have no cross-communication for 3 or 4 cm At this level they break up into a rich plexus which anastomoses freely, and which may extend into the upper third of the esophagus The communicating branches run from the plexus to large periesophageal trunks which, in turn, communicate with the intercostal branches through the diaphragmatic vein to the systemic circulation The veins of the submucosa of the esophagus are very poorly supported by loose connective tissue

As a result, varices develop because the increased flow of blood through the veins and the inability of the muscular elastic fibres to withstand the increased venous pressure In addition, the tendency towards the formation of varicosities is accentuated by the effects of increased intrathoracic pressure

Esophageal varices, as seen through the esophagoscope, present a characteristic picture The varicoceles appear as tortuous, often nodular, light bluish prominences which protrude into the esophageal lumen, they are easily compressible and change shape with peristalsis of the esophagus They tend to run in a longitudinal plane and may be so large and numerous that they occupy the entire esophageal lumen

The diagnosis of the esophageal varices is too often made at the autopsy table One should be suspicious in any case where there is a history of unexplained massive gastrointestinal bleeding

Careful Roentgenological examination of the esophagus will usually reveal the presence of varices Occasionally the diagnosis can be made only by esophagoscopy

The purpose of injecting a sclerosing solution into the esophageal varices is to block the free passage of blood through the esophageal vein One hopes to stimulate a border circulation to increase its efficiency in conveying blood back through the liver to the systemic circulation in a normal manner, however, the more important reason is the stimulation of new anastomotic channels to convey the blood from the portal to the systemic circulation by such a route that the communication will not be subjected to trauma as occurs in the esophagus

Splenectomy, as we know, is the procedure which has given the most satisfactory results in cases in which the esophageal varices were due to splenic anemia Splenectomy alone will cure only that relatively small group of thrombosis of the splenic veins in which the site of obstruction is distal to the junction of the coronary veins Dr Will Mayo pointed out that this procedure should be of value if for no other reason than that the removal of the spleen decreases by 20 per cent the amount of blood that passes through the portal circulation In so doing, this lessens the amount of blood that must be transmitted back to the systemic circulation by the portal system Recurrence of hemorrhage subsequent to splenectomy is, however, not unusual The recurrence of hemorrhage from esophageal varices after splenectomy takes place in approximately 50 per cent of the cases

It becomes readily apparent, therefore, that any procedure that can prevent such bleeding is deserving of serious consideration In 1933, Pemberton and Walters each suggested the advisibility of injecting a sclerosing solution into the esophageal varices They suggested injection through an esophagoscope or into the coronary vein at the time of surgical intervention Crafoord and Franckner, of Stockholm, in 1939, were the first to successfully inject the esophageal varices with a sclerosing solution through an esophagoscope Their success was shortly followed by Moersch's work in this country

The apparatus for injection consists of a firm 11 gauge tube To this a 24 calibre hypodermic needle is attached The proximal end of the tube is bent at right angle to permit free visualization At the proximal end of the tube a short piece of rubber tubing is fitted to allow the attachment of the syringe containing the sclerosing solution The use of the rubber connection is of great value in preventing unnecessary jiggling of the needle during the injection A removable handle which can be attached to the proximal end of the needle has been found of considerable assistance in guiding the needle properly and steadily

The solution which was used by Crafoord and Ranckner was quinine hydrochloride Moersch instigated the use of sodium morrhuate because it is less likely to produce sloughing and severe systemic reaction He first used a 2 5 per cent solution of sodium morrhuate, at the present time a 5 per cent solution is being used because it seems to produce somewhat better and more rapid sclerosis

The technique used, of course, is first the passage of the esophagoscope to the desired level, and a suitable vein is selected for injection The scope is placed gently against the varix, just proximal to the point at which the needle is to be inserted The needle then is inserted into the vein We find it advisable, when in doubt, to remove some blood from the lumen of the vein to make sure that the needle is in its proper place With the needle in proper position, the solution of sodium morrhuate is injected slowly into the vein The amount of solution used depends upon the patient's reaction I have injected as much as 9 cc at one treatment without any ill effect, however, it is advisable to limit the amount injected on the first treatment to be certain that the patient is not sensitive to the drug Only one vein is injected at a time When the needle is withdrawn, there invariably occurs at the site of puncture a small amount of bleeding which can easily be controlled by adrenalin or thromboplastic tampons

In some cases the patient complains about pain which is usually substernal and extends through to the back If pain occurs, it usually takes place after 1 cc to 2 cc of the solution is injected The solution may be escaping into the perivascular tissues, or may be due to a spasm in the vessel itself The pain, however, disappears in 12 to 24 hours Subsequent changes in the vessels take place and they take on a firm, small, pale appearance

1 Hemorrhage or ascites, or both, can occur in cirrhosis cases purely on the basis of depressed liver function *2* Hemorrhage may be due to so-called wasting ascites caused by portal hypertension and at the same time have a perfectly well compensated liver *3* Hemorrhage may be due to the inability of the liver to produce albumin or prothrombin It is of utmost importance to improve liver function to its maximum before making one's decision on the operative procedure

In my series of 19 cases, the ages ranged from 14 to 58 There were 10 males and nine females Twelve cases were so-called typical Banti's, and in seven of these cases varices was diagnosed before splenectomy In the remaining seven cases of the series, the diagnosis of intrahepatic hypertension, or cirrhosis, was made Three of these patients had poor liver function with inability to produce sufficient prothrombin and albumin All of the splenectomy cases suffered hemorrhages before operation

Four of the splenectomized cases went for a period of two to five years before they had a recurrence of bleeding The remaining cases bled anywhere from one month to 18 months after splenectomy *The three cases of poor liver function did very poorly* One of the cases of intrahepatic hypertension with extremely good liver function has gone 16 months, during which time he has been injected on four occasions The remaining three in this group are more recent In the 12 cases of Banti's there were three deaths One of these had gone a little over three years, during which time the varices were injected on five occasions One of the cases has gone five years since I injected him last This man is a secretary for one of our senators from Washington and he informed me that on only one occasion did he have any suggestion of gastrointestinal bleeding

The remaining cases ranged from six months to 18 months In two of these cases I have been unsuccessful in controlling completely their gastrointestinal hemorrhages, but they are greatly improved The other two cases are doing very nicely at the present writing, and one has gone eight months since the last injection, and the other, 13 months

The blood loss at the time of gastrointestinal hemorrhage in some amounts to as much as one to two liters at each episode In a few of the cases the hemoglobin dropped as low as 40 per cent The greatest number of injections in any one case was 12 The total amount of solution used in any one case was 28 cc

Blakemore, of New York, is doing extensive work on the portocaval anastomosis and also the anastomosis of the splenic and renal vessels In his series of 58 cases he has had 11 postoperative deaths, however, I do feel that insofar as vascular surgery is concerned, he has opened up new hopes for further treatment of these cases

SUMMARY

1 Splenectomy alone, although the most reliable and time honored surgical treatment for this condition, is not the conclusive answer to the problem

2 Splenectomy by relieving over 20 per cent of the load from the portal circulation, followed by the injection of a sclerosing solution into the varices, has proved very helpful These injections, however, have had to be repeated in many cases

3 Blakemore's portocaval anastomosis, combined with the above procedures, will add greatly to the success in treatment of esophageal varices

BIBLIOGRAPHY

Walters W Moersch H J and McKinnon, D A. Bleeding Esophageal Varices *Arch Surg* 41 1101 1117 1940

McIndoe, A. H Vascular Lesions of Portal Cirrhosis *Amer Jour Med Sci* 127 24-25 1928

Mayo W J The Enlarged Spleen *Calif and West Med*, 3 383-386 1929

Pemberton, J deJ Results of Splenectomy in Splenic Anemia Hemolytic Jaundice and Hemorrhagic Purpura *Ann Surg* 94 755 765 1931

Rowntree L F Walters, W and McIndoe A H End Result of Tying of the Coronary Vein for Prevention of Hemorrhage from Esophageal Varices *Proc Staff Meet*, *Mayo Clin*, 4 263 264 1929

Grace, Edwin J Control of Massive Esophageal Hemorrhage Secondary to Liver Damage (Cirrhosis) by Ligation of the Coronary Vein and Injection of Sodium Morrhuate *Ann Surg* 116 387-393 1942

Blakemore, A H Indications for Portocaval Anastomosis Analysis of Cases *Surg*, *Gynec and Obst*, 84 645-653 1947

Samson P C and Foree L Direct Injection of Esophageal Varices Through the Esophagoscope *West Jour Surg*, *Obst and Gynec* 50 73 77 1942

Hemming, R G and Snell, A M Portal Cirrhosis with Ascitis An Analysis of 200 Cases with Special Reference to Prognosis and Treatment *Ann Digest Dis*, 9 15 Apr 1942

Patek A. J Jr. Treatment of Alcoholic Cirrhosis of the Liver with High Vitaminic Therapy *Proc Soc Exp Biol and Med*, 37 329 Nov 1937

Patek A. J Jr and Post J Treatment of Cirrhosis of the Liver by a Nutritious Diet and Supplements Rich in Vitamin B Complex *Jour Clin Inves* 20 481 Sept 1941

"THE FUNCTION OF THE EAR IN HEALTH AND DISEASE"

Unusual Educational Sound and Color Film, Edited by H G Kobrak, M D , Ph D , Joseph E Hind and Robert B Miller, M D

This film was produced at the University of Chicago and its purpose is to demonstrate the response of the ear to sound in health and disease The range which the ear can perceive is demonstrated The minimum and maximum intensity of sound recorded by the ear is shown Pathology of the middle ear is demonstrated on diseased temporal bones The vibrating eardrum after paracentesis is demonstrated The inflation after Politzer and the effect on the eardrum is shown

Hearing curves of certain types of deafness are shown and the response of the ear is demonstrated By using electronic filters, the sound perception of a diseased ear is given in the sound track similar to the actual hearing defect, therefore, the audience is able to see the pathologic function on the screen and simultaneously hear the distorted acoustic signal which the patient perceives

The audiometric hearing curve of a patient obtained before fatal termination of his disease is shown The acoustic vibrations of this diseased temporal bone are demonstrated

The action of hearing aids and intensity changes due to the action of the hearing aid is demonstrated The reflex of the middle ear muscles is demonstrated in animal experiments and in patients The utilization of the stapedius reflex for objective hearing tests is demonstrated

This is the first film of its kind ever attempted and successfully accomplished for visual education in otology

The film is available to medical societies, hospitals, universities and professional study groups without charge through the Auralgan Research Division, 100 Varick Street, New York 13, N Y

MISSISSIPPI VALLEY MEDICAL SOCIETY
1949 ESSAY CONTEST

The Ninth Annual Essay Contest of the Mississippi Valley Medical Society will be held in 1949 The Society will offer a cash prize of $100 00, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics and education) and practical value to the general practitioner of medicine Certificates of merit may also be granted to the physicians whose essays are rated second and third best Contestants must be members of the American Medical Association who are residents and citizens of the United States The winner will be invited to present his contribution before the Fourteenth Annual Meeting of the Mississippi Valley Medical Society to be held in St Louis, Mo , Sept 28, 29, 30, 1949, the Society reserving the exclusive right to first publish the essay in its official publication — the *Mississippi Valley Medical Journal* (incorporating the *Radiologic Review*) All contributions shall be typewritten in English in manuscript form, submitted in five copies, not to exceed 5,000 words, and must be received not later than May 1, 1949 The winning essays in the 1948 contest appear in the January, 1949, issue of the *Mississippi Valley Medical Journal* (Quincy, Ill)

Further details may be secured from Dr Harold Swanberg, Secretary, Mississippi Valley Medical Society, 209-224 W U U Building, Quincy, Ill

APRIL 1, 1949

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp , 580 Fifth Ave , New York 19, N Y

Aurex (Semi-Portable) , Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp , 1117 N Franklin St , Chicago, Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac.

Manufacturer Beltone Hearing Aid Co , 1450 W 19th St , Chicago, Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl , New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co , Inc , 10 East 43rd St , New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co , Inc , 50 W 29th St , New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co , Inc , North Third St , Minneapolis, Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp , 1 W 34th St , New York, N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co , 727 Atlantic Ave , Boston 11, Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co, 4602 Nicollet Ave Minneapolis 9 Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories 815 S Hill St Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4

Manufacturer Otarion Hearing Aids 159 N Dearborn St Chicago Ill

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)

Manufacturer Paraphone Hearing Aid, Inc, 2056 E 4th St Cleveland Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale Chicago 14 Ill

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone

Manufacturer E A. Myers & Sons 306 Beverly Rd Mt Lebanon Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp 6001 W Dickens Ave Chicago Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp 101 Tremont St Boston 8 Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc 2454 S Michigan Ave Chicago Ill

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex, Inc, Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc, 1627 Pacific Ave, Dallas 1, Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm, Inc, 400 W Lake St., Libertyville, Ill

Unex Model "A"

Manufacturer Nichols & Clark, Hathorne, Mass

Vactuphone Model 3

Manufacturer Allen Howe Electronics Corp, Salem, Mass

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc, 120 Broadway, New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp, 6001 Dickens Ave, Chicago, Ill

All of the accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Marvin F Jones, 121 E. 60th St., New York 22, N Y
Secretary Dr Gordon D Hoople, Medical Arts Bldg , Syracuse 3 N Y
Meeting New York, N Y., May 18-19, 1949

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Frederick T Hill, Professional Bldg , Waterville, Me
Secretary Louis H. Clerf, 1530 Locust St., Philadelphia 2, Pa.
Meeting New York, N Y May 16 17, 1949

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin, 384 Post St San Francisco 8 Calif
Secretary Dr C Stewart Nash, 708 Medical Arts Building Rochester N Y

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward 104 E. Market St Charlottesville Va.
Secretary Dr James M. Robb 641 David Whitney Bldg Detroit, Mich.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens 35 E 70th St New York N Y
President Elect Dr J Mackenzie Brown 1136 W 6th St., Los Angeles Calif
Executive Secretary Dr William L Benedict Mayo Clinic Rochester Minn.

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E. Ashley 384 Post St San Francisco Calif
Secretary Treasurer Dr Joseph Hampsey 806 May Bldg Pittsburgh 22 Pa.

AMERICAN BOARD OF OTOLARYNGOLOGY

Meeting New York, N Y, May 11 14, 1949

PAN AMERICAN ASSOCIATION OF OTO RHINO LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L Jackson, 255 S 17th St, Philadelphia, Pa

Second Pan American Congress of Oto Rhino Laryngology and Broncho-Esophagology Montevideo, January, 1950

AMERICAN BRONCHO ESOPHAGOLOGICAL ASSOCIATION

President Dr Paul Holinger, 700 N Michigan Ave, Chicago 11, Ill

Secretary Dr Edwin N Broyles, 1100 N Charles St. Baltimore 1 Md

Meeting Chicago, Ill, April 18 20, 1949

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Warren A Wilson

Secretary Treasurer Dr Victor Goodhill

Chairman of Section on Ophthalmology Dr George Landegger

Secretary of Section on Ophthalmology Dr Harold B Alexander

Chairman of Section on Otolaryngology Dr Alden H Miller

Secretary of Section on Otolaryngology Dr Leland R House

Place Los Angeles County Medical Association Bldg, 1925 Wilshire Blvd, Los Angeles, Calif

Time 6 P M, fourth Monday of each month from September to May, inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner, 115 E 61st Street, New York 21, N Y

Secretary Dr Norman N Smith, 291 Whitney Avenue, New Haven 11 Conn

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave, North Nashville 3, Tenn

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg, Atlanta 3, Ga

Vice Chairman Dr V R Hurst, 315 N Center St, Longview, Tex

Secretary Dr Alston Callahan, 908 S Twentieth St, Birmingham 5, Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M. Valentine Miller, 114 W Phil Ellen St. Philadelphia Pa.
Vice-President Dr Thomas F Furlong Jr, 36 Parking Plaza, Ardmore, Pa.
Treasurer Dr Harry P Schenck, 1912 Spruce St., Philadelphia, Pa
Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave., Philadelphia 18, Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Vicente Banet
Vice-Presidente Dr José Lastra
Secretario Dr René Smith.
Vice-Secretario Dr Luis Rodriguez Baz
Tesorero Dr Antonio Rodrigues Diaz
Vice-Tesorero Dr Tomás Armstrong

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER — CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice-Presidente Dr Luis E Olsen.
Secretario Dr Eugenio Romero Diaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez, Dr Nondier Asis R Dr Jorge Bergallo Yofre

FOR SALE

Miscellaneous Back Numbers

THE LARYNGOSCOPE

Volume 1 (1896) to
Volume 58 (1948)

THE LARYNGOSCOPE
640 South Kingshighway
ST. LOUIS 10, MO.

THE
LARYNGOSCOPE.

VOL LIX MAY, 1949 NO 5

POLIOMYELITIS-TONSILLECTOMY SURVEY — 1948 *†

DANIEL S CUNNING, M D ,
New York, N Y

In previous reports,[1,2,3] a review of the literature was presented regarding the relationship of tonsillectomy to poliomyelitis There is no need to repeat those citations, but it is of interest to report that authorities now regard poliomyelitis not as a single disease entity caused by a sole agent, but rather as a group of diseases having in common certain clinical symptoms and caused by a family of more or less related viruses

Investigators have presented evidence that at least three immunogenic types of polio virus exist, each type consisting of numerous individual strains How many more of these types there may be still remains to be determined It has also been reported recently that a human polio virus may be grown in extraneural tissue and that an experimental vaccine has successfully immunized monkeys From all these reports, it may not be too optimistic to believe that within the near future a definite means of prevention or control of the disease may be possible, which will make the question as to a causal

---

*Read at the Fifty third Annual Meeting of the American Laryngological Rhinological and Otological Society Inc Chicago Ill April 18 1949

†From the Manhattan Eye Ear and Throat Hospletal New York N Y

Editor s Note This ms received in Laryngoscope Office and accepted for publication April 25 1949

TABLE I

CASES OF POLIOMYELITIS — BY AGE — TYPE OF DISEASE — OPERATIVE PROCEDURES

				Bulbar			Spinal			Mild		
Age	Total Cases	Following T & A	Following Other Op	Total Cases	Following T & A	Following Other Op	Total Cases	Following T & A	Following Other Op	Total Cases	Following T & A	Following Other Op
0 5	4276	19	8	430	13	2	2667	5	6	1179	1	0
6 10	2594	17	7	365	11	1	1312	3	4	917	3	2
11 15	1454	1	6	250	1	1	688	0	3	516	0	2
16 and over	2300	2	11	436	2	3	1192	0	6	672	0	2
Total	10,624	39	32	1481	27	7	5859	8	19	3284	4	6

TYPE OF DISEASE—OPERATIVE PROCEDURES—CASES OF POLIOMYELITIS BY STATE

State	Total Cases	Following T & A	Following Other Op	Bulbar Total Cases	Bulbar Following T & A	Bulbar Following Other Op	Spinal Total Cases	Spinal Following T & A	Spinal Following Other Op	Mild Total Cases	Mild Following T & A	Mild Following Other Op
Vermont	18	0	0	1	0	0	12	0	0	2	0	0
Oregon	156	0	0	25	0	0	103	0	0	28	0	0
Arizona	82	1	0	8	0	0	51	1	0	20	0	0
Illinois	787	0	0	90	0	0	261	0	0	138	0	0
Kansas	272	1	1	12	1	1	163	0	0	67	0	0
Rhode Island	9	0	0	0	0	0	9	0	0	0	0	0
Maine	30	0	0	1	0	0	12	0	0	11	0	0
New Hampshire	17	0	1	1	0	0	10	0	1	6	0	0
Connecticut	120	0	0	10	0	0	75	0	0	35	0	0
Delaware	135	3	0	27	3	0	63	0	0	55	0	0
Louisiana	133	2	3	18	2	2	89	0	1	26	0	0
Arkansas	111	1	2	26	1	1	103	0	1	15	0	0
Alabama	117	0	0	6	0	0	91	0	0	50	0	0
S Dakota	993	1	3	225	1	2	550	0	1	218	0	0
New Mexico	3	0	0	1	0	0	1	0	0	1	0	0
Texas	989	0	0	116	0	0	737	0	0	106	0	0
Massachusetts	115	0	0	8	0	0	55	0	0	52	0	0
Colorado	116	1	0	21	1	0	67	0	0	25	0	0
Utah	182	1	1	19	1	0	118	0	1	15	0	0
Wyoming	76	0	0	13	0	0	39	0	0	21	0	0
New Jersey	639	2	2	67	1	0	186	1	1	86	0	1
Missouri	187	0	0	32	0	0	112	0	0	13	0	0
Mississippi	123	0	0	6	0	0	69	0	0	18	0	0
N Carolina	1227	3	3	155	2	0	660	0	2	112	1	1
Georgia	183	1	0	30	0	0	80	1	0	73	0	0
Ohio	970	4	8	131	1	0	185	2	5	351	1	3
N Dakota	11	0	0	6	0	0	18	0	0	17	0	0
Florida	166	0	1	27	0	1	57	0	0	82	0	0
S Carolina	212	1	0	30	0	0	128	1	0	81	0	0
Nebraska	277	0	1	31	0	0	116	0	1	97	0	0
Tennessee	103	0	0	18	0	0	11	0	0	11	0	0
Kentucky	112	2	0	11	1	0	59	0	0	12	1	0
Pennsylvania	228	3	0	23	1	0	138	1	0	67	1	0
New York State	1107	7	1	131	6	0	569	1	3	107	0	1
Maryland	118	0	2	23	0	0	17	0	2	18	0	0
Michigan	377	2	0	30	2	0	162	0	0	185	0	0
Total	10 621	39	32	1181	27	7	5859	8	19	3281	1	6

relationship of tonsillectomy to poliomyelitis merely an academic one. Until control or prevention is certain, the question whether recent tonsillectomy heightens the dangers of contracting poliomyelitis is of acute interest to the medical profession and to the public alike, and means must be taken to ascertain the true relationship.

TABLE III

Distribution by Types of Involvement. Number and Per Cent

Year 1946		Cases Preceded by T & A		Cases Preceded by Other Ops	
Type	Total Cases	No	%	No	%
Bulbar	382	18	4.7	9	2.4
Spinal	1292	24	1.9	11	0.8
Mild	616	14	2.3	6	1.0
Total	2290	56	2.5	26	1.1
Year 1947					
Bulbar ..	509	6	1.2	16	3.2
Spinal	2230	10	0.5	15	2.0
Mild	1592	8	0.5	20	1.3
Total	4331	24	0.55	81	1.9
Year 1948					
Bulbar	1481	27	1.7	7	0.5
Spinal	5859	8	0.13	19	0.32
Mild ..	3284	4	0.12	6	0.18
Total	10624	39	0.37	32	0.3

Since 1946, the writer, with the cooperation of otolaryngologists throughout the country, has been compiling accurate statistics to determine whether a causal relationship exists between tonsillectomies and poliomyelitis. The surveys conducted in 1946 and 1947 did not justify the conclusion that a causal relationship existed. Out of 2,290 poliomyelitis cases tabulated in 1946, 56, or 2.5 per cent, gave histories of recent

TABLE IV

Distribution by Age. Number and Per Cent—Preceded by T. & A.s and Other Operations

		Cases Preceded by T & A		Cases Preceded by Other Ops	
Age	Total Cases	No	%	No	%
		Year 1946			
0-5	658	16	2.4	2	0.3
6-10	807	35	4.3	10	1.2
11-15	484	4	0.8	3	0.6
16 and over	527	7	1.3	12	2.2
Total	2476	62	2.5	27	1.1
		Year 1947			
0-5	1167	4	0.3	25	2.2
6-10	1236	15	1.2	18	1.5
11-15	914	3	0.3	10	1.1
16 and over	1014	2	0.2	28	2.7
Total	4331	24	0.5	81	1.9
		Year 1948			
0-5	4276	19	0.44	8	0.17
6-10	2594	17	0.61	7	0.27
11-15	1454	1	0.07	6	0.41
16 and over	2300	2	0.09	11	0.47
Total	10624	39	0.37	32	0.3

tonsillectomies In the following year (1947), out of 4,331 cases reported, 24, or 0.55 per cent, had had previous tonsillectomies

TABLE V

Bulbar Cases Following Tonsillectomy

Locality	Age	Number of Days Following T & A
Louisiana	7	15
South Dakota	5	20
North Carolina	6	16
Kansas	7	1
Ohio	7	20
Delaware	5	21
Kentucky	5	10
Utah	5	5
South Dakota	1	21
Pennsylvania	5	0
Delaware	6	21
Arkansas	5	1
Michigan	5	8
New Jersey	5	21
New York	12	21
Delaware	17	8
Michigan	10	11
New York	6	11
South Dakota	0	14
New York	3	18
North Carolina	6	7
New York	4	21
Louisiana	8	11
New York	4	8
South Dakota	5	11
New York	4	21
Colorado	1	18

As reported in 1946 and 1947, the evidence of the surveys was not sufficient to permit drawing a definite conclusion whether or not a causal relationship existed between tonsillectomies and poliomyelitis. The results were directly at variance with the freely expressed belief of certain authorities that recent tonsillectomies predisposed to a high incidence of poliomyelitis, a belief based for the most part on experimental evidence and on limited clinical surveys.

TABLE VI

Deaths from Poliomyelitis

Age Group	Cases of Poliomyelitis	Number in Which Death Resulted	Case Fatality Rate
	Year 1946		
0-5	658	23	3.5
6-10	807	27	3.3
11-15	711	40	5.6
16 and over	300	30	10.0
Total	2,476	120	4.8
	Year 1947		
0-5	1,167	17	1.5
6-10	1,236	17	1.5
11-15	914	20	2.2
16 and over	1,014	40	4.0
Total	4,331	94	2.2
	Year 1948		
0-5	4,276	158	3.7
6-10	2,594	113	4.3
11-15	1,454	95	6.5
16 and over	2,300	207	9.0
Total	10,624	573	5.4

When reporting the 1947 survey, the writer proposed a new approach to the problem and one that might well provide a conclusive answer Instead of obtaining, through state health departments and private physicians and surgeons, the

TABLE VII

Bulbar Type of Poliomyelitis	
Year 1946	
Total number cases polio	2 476
Total number cases—bulbar type	382 or 15 4%
Bulbar cases following T & A	18 or 4 7%
Bulbar cases following other operations	9 or 2 4%
Bulbar cases following no operations	355 or 92 9%
Year 1947	
Total number cases polio	4,331
Total number cases—bulbar type	509 or 11 6%
Bulbar cases following T & A	6 or 1 2%
Bulbar cases following other operations	16 or 3 2%
Bulbar cases following no operations	487 or 95 6%
Year 1948	
Total number cases polio	10 624
Total number cases—bulbar type	1,481 or 14%
Bulbar cases following T & A	27 or 1 8%
Bulbar cases following other operations	7 or 0 5%
Bulbar cases following no operations	1,447 or 97 9%

records of poliomyelitis cases which had already occurred an then searching their histories for evidence of previous recen tonsillectomies, it was proposed to set up a study which woul answer directly the pertinent question — "are children wh have been tonsillectomized during the summer months more likely to contract poliomyelitis than nontonsillectomized children of the general child population?"

TABLE VIII

Diseases and Accidents Preceding Onset of Poliomyelitis

Dog bite
Conjunctivitis
Epilepsy
Measles
Inguinal hernia repair—hydrocele
Incision and drainage—rectal fistula
Cleft palate repair
Rib resection
Broken foot (cast)
Miscarriage
Strained back
Infected foot
Pregnancy
Herniotomy
Tonsillectomy and adenoidectomy
Brain abscess
Appendectomy
Auto accident with lacerations
Extra uterine pregnancy
Peritonsillar abscess

Active rheumatic fever
Tetanus injection
Torn nail—thumb injury
Tooth extraction
Impetigo
Pneumonia
Harelip repair
Falls
Lacerations—hand and scalp
Injuries—nose back and hand
Diabetes
Streptococcus throat
Immunization injection
Radium treatment—nasopharynx
Pleurisy
Chicken pox
Mumps
Croup
Sulfa and penicillin therapy
Otitis media

As outlined, the study would follow several thousand children who would ordinarily be tonsillectomized during the months of June, July, August and September So that varying epidemic characteristics of the disease would be properly balanced, it was planned to select approximately 20 hospitals throughout the United States for cooperation in the study At the time of admission to the hospital, there would be attached to the regular chart a special card listing pertinent information regarding age, sex, color, date of tonsillectomy and space for comments for a weekly three-month follow-up study Following tonsillectomy and the patient's discharge from the hospital, the card would be turned over to special social service workers for follow-up at weekly intervals to determine whether or not poliomyelitis ensued Such a study, properly supervised and tabulated, would give conclusive evidence whether the incidence of poliomyelitis in recently tonsillectomized children was significantly greater than the normal incidence of the disease in the general child population

Although strongly urged at the time, this particular study has not yet been undertaken Financial and organizational problems have thus far prevented its initiation, but there is still hope that the difficulties may be overcome and the study made

Failing to obtain the necessary support for the above mentioned comparative study, the writer has continued with the original study initiated in 1946 and 1947

During 1948 the United States suffered an epidemic of poliomyelitis comparable to the most severe in its history The United States Public Health Service reported a total of 27,894 cases Continued cooperation from our state chairmen and state health departments resulted in a compilation of statistics from 10,624 of all cases occurring, a percentage of 39 This compared with 2,290 cases studied in 1946, a percentage of eight, and 4,331 in 1947, a percentage of 40

Of the 10,624 cases on which data were received, 38 had histories of previous tonsillectomies — an incidence of 0 36 per cent A breakdown of the 10,624 cases revealed that 1,481 had the bulbar type of poliomyelitis In this bulbar group, 27 were preceded by tonsillectomies — an incidence of 1 7 per cent Of the 5,859 cases listed as spinal type, eight, or 0 13 per cent, gave histories of tonsillectomies In the 3,284 cases recorded as "mild," four, or 0 12 per cent, had recent tonsillectomies All tonsillectomies occurred one to 30 days prior to the onset of poliomyelitis

TABLE IX.

Tonsillectomies—Year 1948

State	Cases Reported	Contracted Bulbar Polio
New York	3,511	0
Delaware	2,765	3
Canada	2 064	0
Illinois	1 868	2
Pennsylvania	1,403	0
Massachusetts	1,259	0
North Carolina	1 231	0
New Jersey	671	0
Tennessee	500	0
Ohio	379	0
Maine	362	0
Michigan	340	0
South Carolina	333	0
Indiana	266	0
Connecticut	220	0
Wisconsin	210	0
Rhode Island	200	0
Texas	180	0
Washington D C	102	0
Colorado	100	0
Kansas	96	0
Washington	88	0
Oregon	81	0
California	77	0
Hawaii	69	0
Missouri	21	0
Total	18 396	5

In the 10,624 total cases in the survey, 32, or 0 3 per cent, were preceded by operations other than tonsillectomy (appendectomy, herniotomy, etc) In the 1947 survey, 81, or 1 9 per cent, of the 4,331 cases were preceded by operations other than tonsillectomy, and in 1946, 26, or 1 1 per cent, of the 2,290 cases were preceded by similar "other operations"

Keeping in mind the warning that during epidemics children who are tonsillectomized have an increased danger especially to bulbar poliomyelitis, it is interesting to observe that in the 1946 series of cases, out of a total of 382 bulbar cases, 355, or 92 9 per cent, occurred without any preceding operation In the 1947 group studied, 509 were of the bulbar type, of which 487, or 95 6 per cent, occurred without any recorded history of recent tonsillectomies or other operative procedures, in the year 1948, 1,481 bulbar cases occurred in the group under survey Of these bulbar cases, 1,450, or 97 9 per cent, occurred without history of recent operations

TABLE X

Tonsillectomies—1937 to 1949	
Reported at the Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc , St Louis, April 26, 1947, tonsillectomies performed at the Manhattan Eye, Ear and Throat Hospital during the summer months of 1937, 1939, 1941, 1942 1943, 1944, 1945	11 204
Reported in 1947 (National Survey)	5 439
Reported in 1948 (National Survey)	18,396
	35,039
From this total of 35 039 cases of tonsillectomies which were followed for a two month postoperative period, only five contracted bulbar poliomyelitis	0 014%

CONCLUSIONS

After 10 years' study of this subject, following over 17,000 poliomyelitis cases and 35,000 tonsillectomy cases, I am still of the same opinion that I was one year ago, namely that no definite causal relationship between tonsillectomy and poliomyelitis has been established, therefore, I do not believe that tonsillectomy should be postponed indefinitely simply because the summer months are the months during which poliomyelitis is prevalent If, however, there is a distinct rise in the poliomyelitis rate, bordering on epidemic proportions, in any community, all elective operations should be postponed

Until evidence of a conclusive nature is forthcoming, the surgeon should decide whether or not to perform tonsillectomies during the summer months and whether the dangers of delaying the operation are greater than the still undetermined risk of increasing susceptibility to poliomyelitis

REFERENCES

1. CUNNING D S Tonsillectomy and Polio *Ann Otol Rhinol and Laryngol*, 55 3 583 Sept., 1946

2 CUNNING D S Tonsillectomy and Polio *Arch Otol* 46 575 583 Nov 1947

3 CUNNING D S Tonsillectomy and Polio THE LARYNGOSCOPE, 58 6 503 513 June 1948

TWO-ROOM AUDIOMETRY SETUP FOR THE OTOLOGIST'S OFFICE*

WALTER P WORK, M D,
San Francisco, Calif

Since most of the existing clinical tests for the determination of auditory acuity are subjective, it is essential that the individual to be tested be placed in an environment free of excessive extraneous visual and auditory distractions It is axiomatic during pure tone audiometry that the patient be placed so that the turning of dials and switches of the audiometer will not visually influence his responses Likewise, when speech reception audiometry is being performed, all equipment such as racks, turntables, amplifiers and microphones should be placed so as not to distract visually the person being tested, further, the room or rooms for clinical use should be sound treated but not necessarily "dead"

During the existence of the hearing clinic at Borden General Hospital, Chickasha, Okla ,[1] approximately 5,000 patients were treated This meant that several thousand audiograms were recorded Fig 1 shows the routine positioning of a patient at that hearing center during pure tone audiometric testing assuring a minimum of visual and auditory distractions Speech reception testing was carried out in a two-room setup either by the use of headphones or in the free field Pure tone audiometry was also used in the two-room setup for some of the hearing aid selections as a free-field measure of unaided auditory acuity The results compared favorably in most cases with routine monaural pure tone audiometry During that period of time the possibilities of a two-room

---

*Read at the meeting of the Western Section American Laryngological Rhinological Society Los Angeles Calif Jan 29 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 9 1949

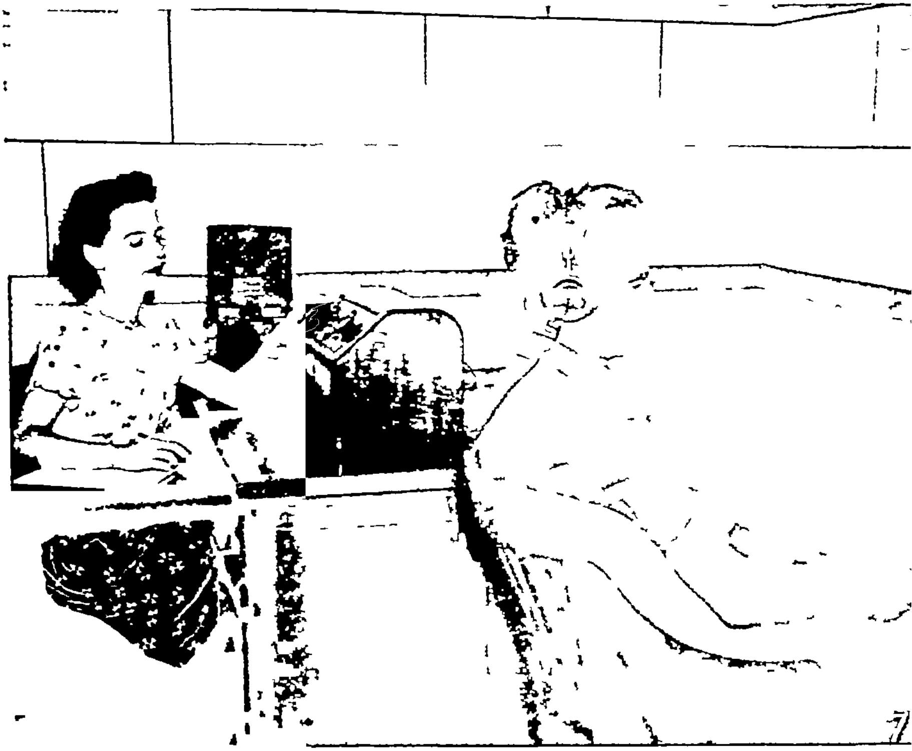


Figure 1. The position of a patient during pure tone monaural audiometry at the Hearing Clinic Borden General Hospital

setup for pure tone and speech reception audiometry for the otologist's office were discussed[2] It was the foregone conclusion that speech reception testing would be satisfactory providing the necessary equipment and personnel were available Since there was no precedent for pure tone monaural audiometry in a two-room setup, the only way to determine its feasibility was to establish such a unit A search of the literature made for clues as to what such a setup should include brought no results[3]

Early in 1948, in private practice, existing office space consisting of two small rooms, one of which was already sound treated, became available for pure tone monaural audiometry (see Figs 2 to 4) This project has been in the process of

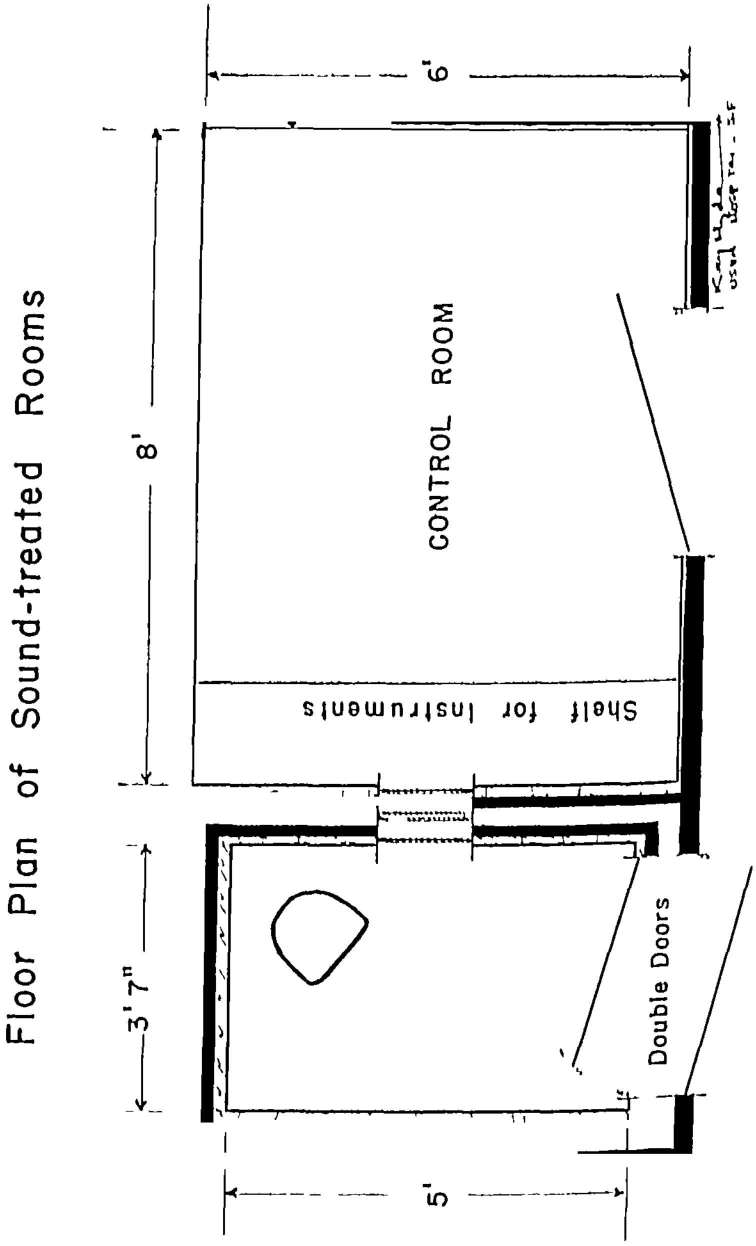


Fig. 2. The floor plan of office space available for sound treated and control rooms.

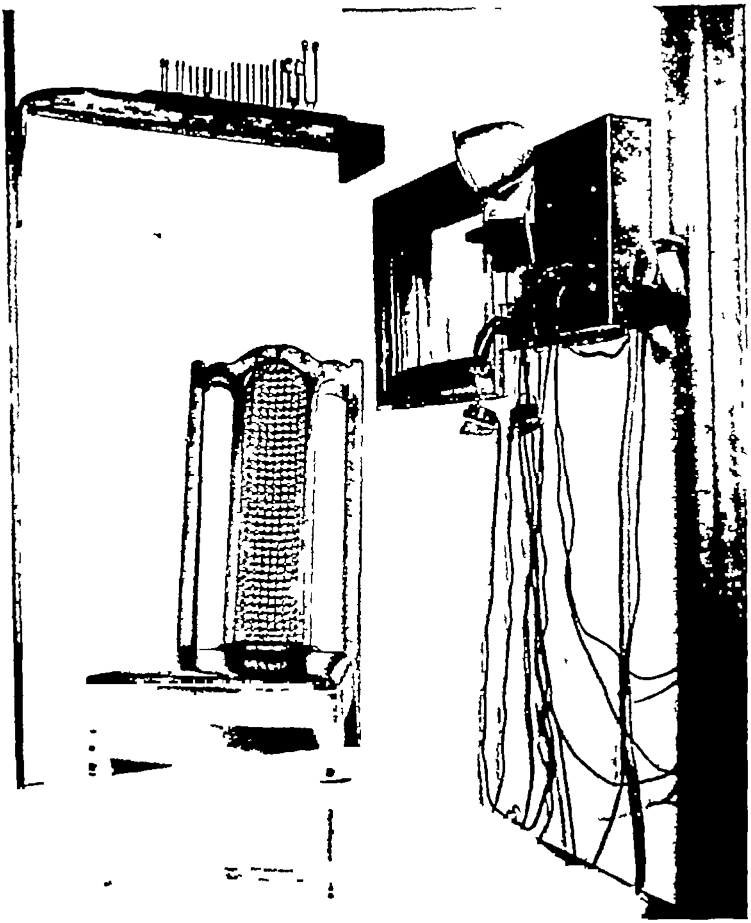


Fig 3 Interior of sound-treated room with electrical-audio equipment Note the loudspeaker of the intercommunication system and the receivers

development for 11 months It is not being presented today with the thought of revolutionizing pure tone audiometric technique but simply as a natural evolutionary step, based on Army experiences, toward the improvement of testing accuracy The advantages and disadvantages of such a setup will be pointed out

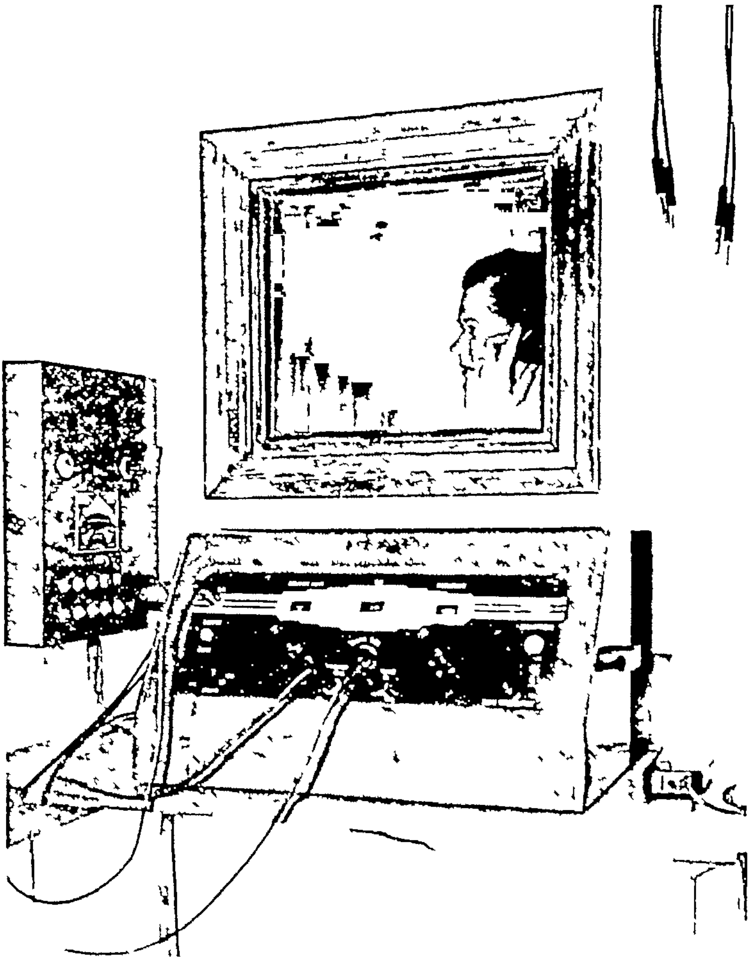


Fig 4 Control room At this stage of development November 1948 the speech production apparatus had not been added In the panel box note binaural and monaural switching dial which associated with the audiometer s microphone or pure tone circuits is used for malingering tests The patch cords are 36 inches in length and are used to connect the audiometer s outputs with the jacks in the panel box. The press-to-talk switch can be seen in the upper right hand corner of the panel box The position of the patient within the sound-treated room is shown

Physical Equipment

The dimensions of the sound-treated room are given in Fig 2 The ambient noise level within this room is consider-

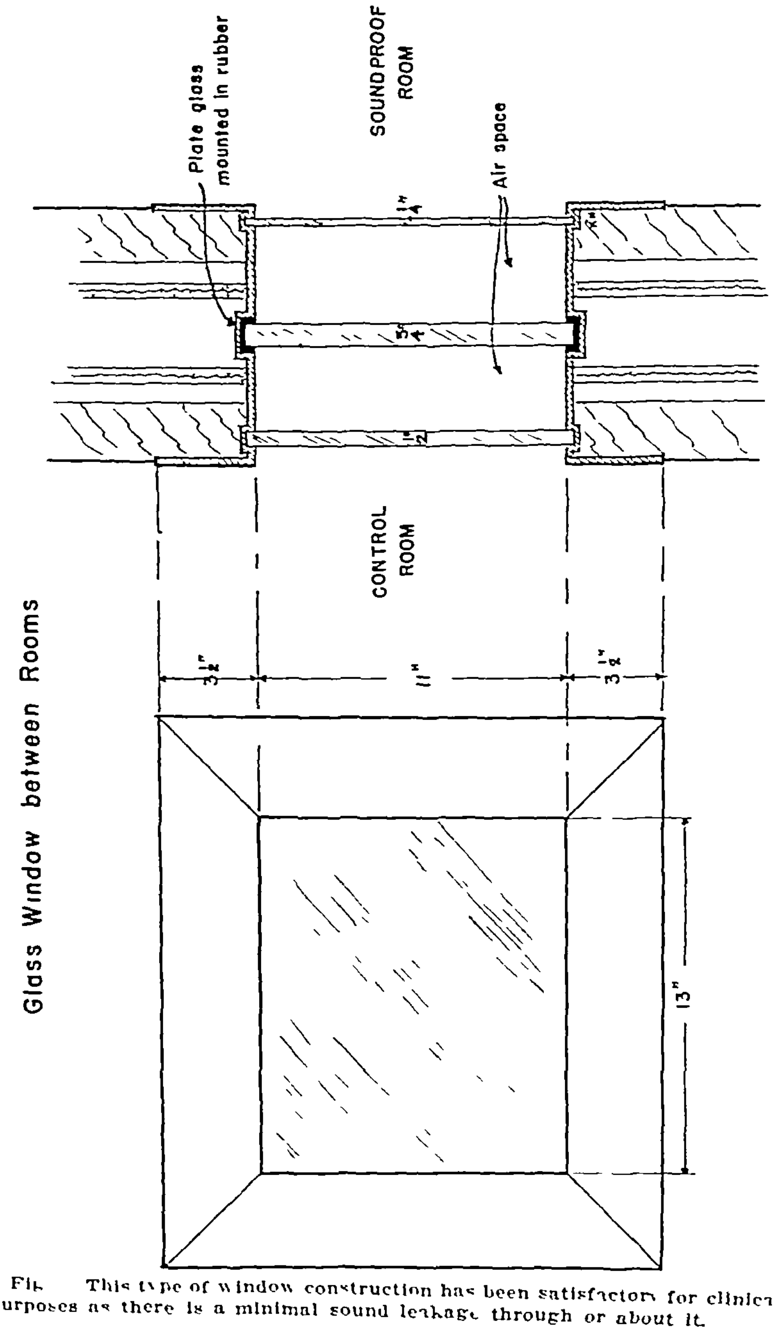


FIG. This type of window construction has been satisfactory for clinical purposes as there is a minimal sound leakage through or about it.

ably below that of the remaining office A room next to the sound-treated room serves as a control room The control room may be smaller than diagramed and if the ambient noise level is low within this room also, "live voice" testing is facilitated The door arrangements to these rooms were such that they did not need to be altered A glass window, as shown in Fig 5, was constructed and placed at a convenient level between the control and the sound-treated room The dimensions of this window are 11 x 13 inches and allow ample visibility The window contains three panes of plate glass measuring three-fourths inch, one-half inch and one-fourth inch, respectively, in thickness The three-fourths inch middle pane is mounted within a rubber seal The other two

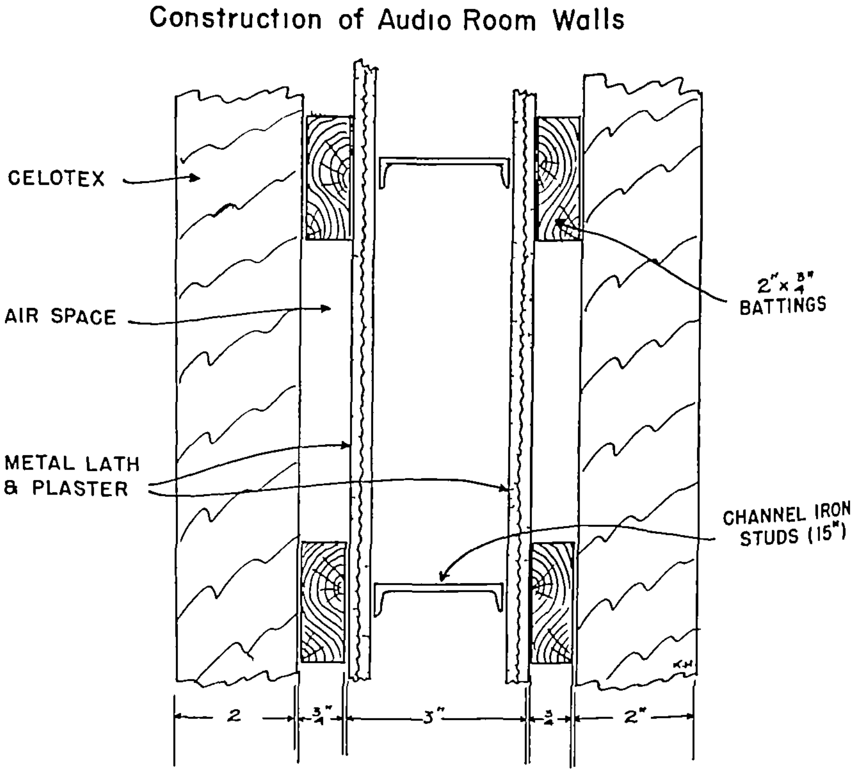


Fig 6 A wall section of the sound-treated room seen from above Note the overall thickness of the wall Such a thickness insures ample air space between the panes of glass in the window

are mounted on either side in grooves in a wooden frame An air space is between each pane of glass so that sound attenuation is obtained For clinical purposes, the construction of the window appears adequate The wall of the sound-treated room wherein this window was placed is some eight and one-half inches thick, as shown in Fig 6 The window frame was placed solidly within this wall and was packed about its frame with insulating rock wool This further insured minimal sound leakage In the control room a shelf for electrical-audio equipment was constructed at a convenient working level with relation to the window It is beyond the scope of this paper to go into the details of the sound treatment of this room, but it may be stated that the same construction as shown in Fig 6 is to be found in the other walls and ceiling

Electrical Equipment

Throughout the construction of electrical equipment simplicity was stressed One of the accepted pure tone audiometers was procured for the source of pure tones The essential features of the electrical equipment between the two rooms are shown in Fig 7

In order that the technician may talk with the patient, there is a press-to-talk microphone circuit When the subject speaks from within the sound-treated room the examiner hears the patient through a microphone loudspeaker circuit which is always open except when the press-to-talk circuit is in use Most hard-of-hearing patients and even some moderately deaf patients can hear satisfactorily through this system Ten pairs of cables run between the control room and the sound-treated room This large number of cables was installed so that flexibility could be maintained As noted in Fig 7, one pair of cables serves for air conduction, one for bone conduction, one for masking, and two pairs serve for binaural and monaural testing The audiometer is connected through these cables by the means of telephone plugs and jacks The receivers and bone oscillator within the sound-treated room have been connected with the terminal end of the cables in the same manner It has been found that the

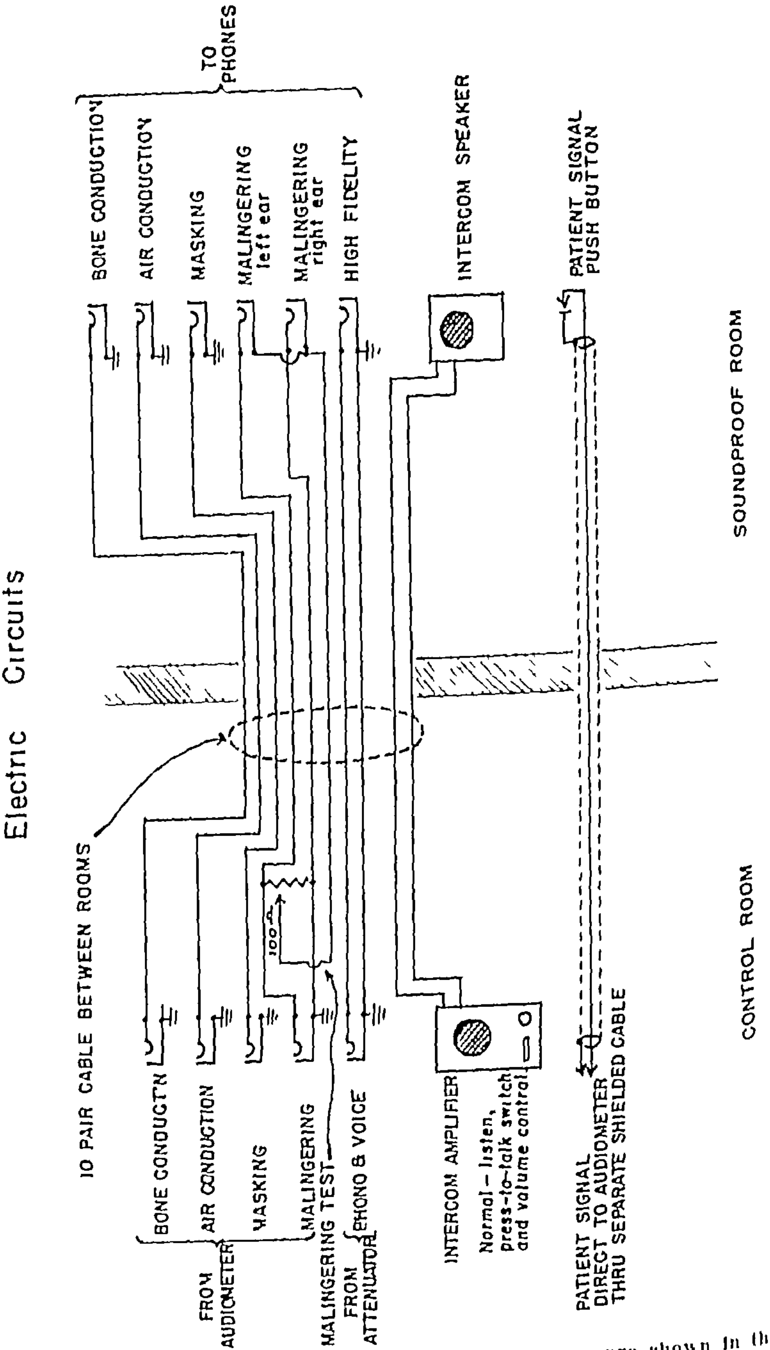


Fig 7 Only seven pairs of wires between the rooms are shown in the illustration The other three pairs are omitted to clarify the picture these circuits have been installed for additional electrical equipment With proper shielding of the wires between rooms the lone cable for the patient's signal would be unnecessary

calibration of the audiometer is the same through this additional circuit as when calibrated in the routine manner The patient's signal light is connected by a different circuit, since none of the 10 pairs of cables between the two rooms was sufficiently insulated to eliminate static A switching device for monaural and binaural malingering tests has been incorporated in the panel box of the control room This circuit has proved to be extremely useful, as will be shown later The electrical equipment needed for pure tone audiometry in this two-room setup, in addition to the equipment that comes with the commercial audiometer, are the several pairs of cables, an intercommunicating system, patch cords and the cable for the patient's signal

Within the past month electrical-audio equipment has been installed for speech reception audiometry (see Figs 8 and 9) The equipment is essentially of the type recommended by Hudgins, *et al*,[4] with additional outlets for "live voice" and a noise generator Since this equipment has not been installed long enough for a thorough clinical test, its details and performance will not be discussed at this time, however, as stated previously, the two-room setup has proved its value in speech reception audiometry

Standard Operating Procedures

The two-room set up such as described does not essentially alter the technique of pure tone monaural audiometry The patient is placed within the sound-treated room at such an angle that his face is partially or fully in view of the operator (see Fig 4) The operator instructs the patient concerning the testing while placing the patient in the sound-treated room The operator then goes to the control room and carries out the pure tone air and bone conduction audiometry The patient is further instructed across the intercommunication system if the occasion arises Three methods are open for the patient's signaling, namely, by the use of the "patient's electrical signal," by the patient stating "on-off" or by the "up-down" method of the index finger In any instance, the signal is readily conveyed to the operator The "on-off" method is

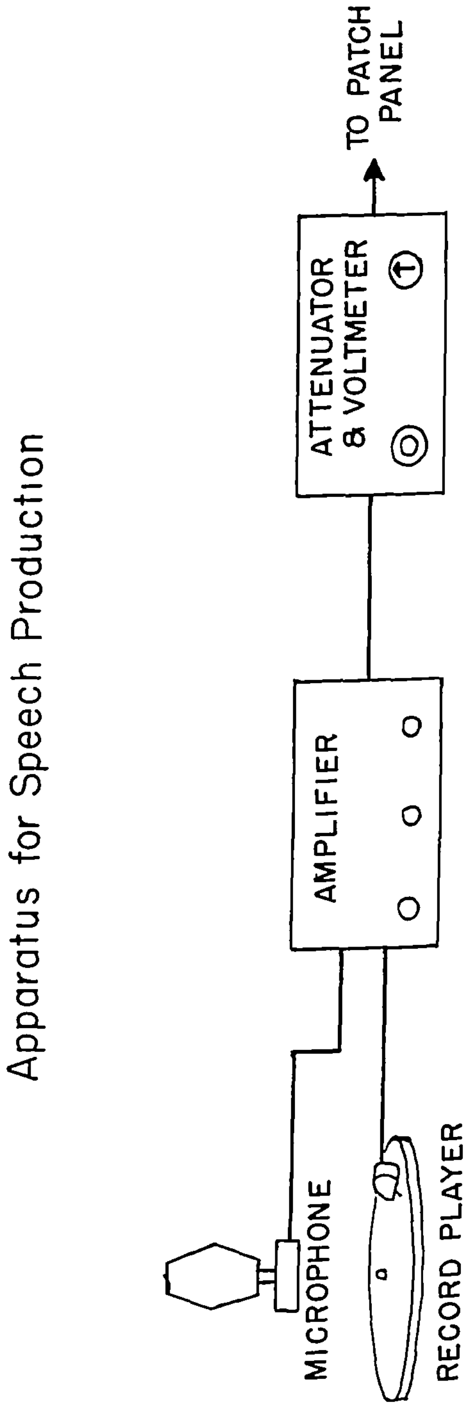


Fig 8 The essential pieces of equipment necessary for speech reception testing The headphones are not shown since they are in the sound treated room

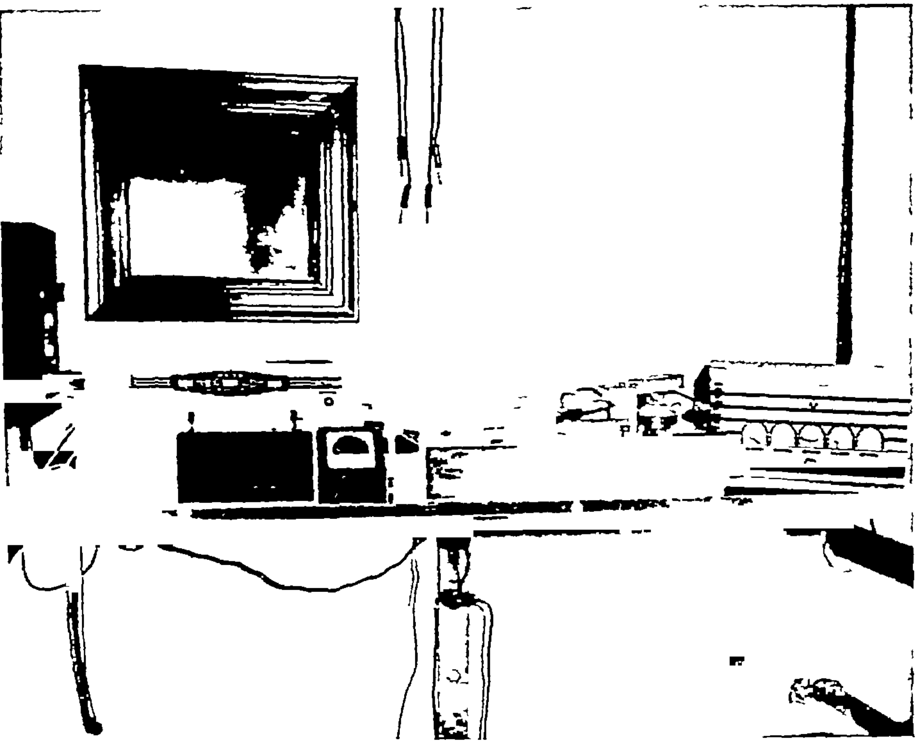


Fig 9 The equipment being installed for the testing of auditory acuity by speech reception The various electrical components are to be racked with an appropriate control panel

used routinely for bone conduction testing because of routine masking, and when one ear is masked in air conduction testing For some children it has been found that testing is more expeditiously carried out by placing one of the parents in the sound-treated room with the child With those patients, children as well as adults, who are difficult to test, it has been found advantageous to place one observer in the sound-treated room with the patient while the operator remains in the control room Routinely, younger children are asked to face the window so that their facial expressions can be watched

By the use of the audiometer's microphone circuit, monaural and binaural articulation testing to detect malingering has been found to be much more reliable in the two-room setup

The binaural headphones can be removed from the headband and used for the Stenger test, using any desired frequency and intensity. The Lombard test can be given monaurally or binaurally by introducing noise (Bárány noise box) through the microphone circuit in the control room. The audiometer's masking circuit may also be used for this test. As the patient reads, the inflection, loudness and softness of the voice can be interpreted on the intercommunication system. Likewise, in further testing for malingering, conversations can be carried on through the microphone circuit either monaurally or binaurally and even some trained listeners may be baffled by switching test material from ear to ear.

The results of the tests are carefully recorded in a so-called log book.[5] The log book contains the date of the test, the name of the patients, type of tests, and comments regarding the accuracy of the tests. Results of calibration of equipment, and changes in equipment are carefully recorded. These data are essential if the results of hearing tests are to be considered reliable and comparable from month to month and year to year.

Comments

Over 600 pure tone monaural audiometry hearing tests have been carried out in this two-room setup. The patients have presented all types and degrees of hearing losses. The youngest children to be tested have been approximately four to five years of age. It appears that pure tone audiometry testing in a two-room setup has been entirely satisfactory in about 96 per cent of the cases. In fact, many of the patients who have been tested, both in the routine manner and the new setup, have commented that the new setup is much more desirable. Their reasons vary from greater accuracy of this method of testing and fewer distractions to simple statements of personal preference. Since the testing of hearing is subjective, the patient's comments are of some significance.

The equipment is simple and easy to operate by the technician. The average technician can master this technique of testing as quickly as routine audiometry. Our technician who has been operating this equipment has had no special training except as obtained in routine clinical work and by doctor's instruction.

The equipment is durable and can be used long hours daily if necessary The electrical equipment has not been excessively expensive to install Calibration of the audiometer even with the additional circuits has been constant Most medico-dental buildings contain X-ray equipment, diathermy equipment, coagulating machines, etc, so some arrangement for the shielding of electrical circuits must be made. This is a problem which can usually be solved without difficulty

The disadvantage of such a two-room setup for pure tone audiometry is the length of time required for the testing, however, the accuracy of the results obtained compensates for the expenditure of time It has also been suggested that the equipment is complicated In practice, this has been disproved This electrical-audio equipment, including the two rooms as now used, is not satisfactory for free-field work, but with modifications and remodeling it could be made to be so Some operators desire to watch facial expressions of the patient and they conclude that audiometry should be done in one room With the two-room setup and the window between, the patient can be placed in a position where facial expressions can be watched if so desired If, after placing an observer in the sound-treated room with a child who is difficult to test and still satisfactory results are not obtained, then it is permissible for the technician to move with the audiometer into the sound-treated room Even by testing such children in the routine manner the results are still sometimes questioned as to reliability In our experience very few children had to be tested in this manner Dix and Hallpike[6] have attempted to solve this problem by developing the peep-show for the pure tone testing of young children

Conclusion

As experience with the two-room setup for pure tone monaural audiometry has accumulated, it appears that its advantages are less distraction for patient, better acceptance of test by patient, greater ease for technician, more accuracy in malingering tests, and greater flexibility Since speech reception techniques are fast becoming an integral part of hearing tests in the otologist's office, and since it is an accepted fact that these tests are ideally carried out in the two-room setup, it then follows that it is a natural evolutionary step in audiometric technique that pure tone monaural audiometry be incorporated in the same two-room setup Data obtained in one of the Army's hearing centers gave impetus for the present undertaking

BIBLIOGRAPHY

1 WORK, W P Aural Rehabilitation Army Experience THE LARYNGOSCOPE, 56 432-443, July, 1947

2 Discussions with H M Boyd M D and Grant Fairbanks Ph D

3 Sources searched

- *a* Index Catalogue of Library of Surgeon General's Office, U S Army, 4th Series, Vol 1, pp 861 863 1936
- *b* Quarterly Cumulative Index Medicus, Vols 17 41, 1935—June, 1947
- *c* Current List of Medical Literature Vols 13 14, No 7, July 4, 1947—Feb 20, 1948
- *d* *Acoustical Society of America Jour* , Vols 1 18, 1929 30, Oct , 1946 Vol 20 Nos 1-4 6 Jan July, Nov , 1948 No foreign language articles were considered

4 HUDGINS, C V *et al* The Development of Recorded Auditory Tests for Measuring Hearing Loss for Speech THE LARYNGOSCOPE, 57 57 89 Jan 1947

5 Suggested by S Richard Silverman, Ph D

6 DIX, M R, and HALLPIKE, C S The Peep Show, A New Technique for Pure Tone Audiometry in Young Children *Brit Med Jour* 2 719 723, Nov 8, 1947

384 Post Street

OTOLARYNGOLOGY
WHAT ARE ITS RESTRICTIONS AND WHERE ARE ITS BORDERLINES?*

FRANCIS L LEDERER, M D ,†
Chicago, Ill

Now, as never before, it is indeed timely for the otolaryngologist to determine his status as a surgical specialist The reason for this is the uncertainty which has betaken those already entrenched in the specialty, and also those contemplating preparation to enter the field While there may be individual experiences to the contrary, existing conditions present notable causes for alarm A militant attitude on the part of leaders in this specialty is called for, lest the "vanishing age of otolaryngology" becomes a reality to record for posterity

A knowledge of the historical factors which permitted otolaryngology to attain its high place in medicine and surgery is important, if we are to appreciate the changes which have already taken place and those which loom as possibilities We would be remiss if we did not remember those of our predecessors who made substantial contributions to the development of otolaryngology Now we are confronted with relinquishing rights to the domains for which our predecessors definitely established priority

History begins to repeat itself When the long-robed (the surgeons) and the short-robed (the barbers) fought it out in the early thirteen hundreds, decadent epochs followed in the

---

*Read at the meeting of the Middle Section American Laryngological Rhinological and Otological Society Inc Iowa City Iowa Jan 17 1949

†From the Department of Otolaryngology University of Illinois College of Medicine

Editor s Note This ms received in Laryngoscope Office and accepted for publication Jan 24 1949

wake of the many controversies Stalemates and petty bickerings retarded progress and leaders in medicine referred to otolaryngology as quackery In so doing, they were actually responsible for aiding charlatan practices

Clendening has remarked "The plight of a patient with an eye or ear disease up to the end of the eighteenth century was pitiable to the extreme" Actions, which must in all candor be recognized as counterparts of the bigoted thinking of the previous era, are beginning to manifest themselves in the twentieth century The so-called "gold era of otolaryngology" is threatened with arbitrary restrictions which could eventuate in the final extinction of the specialty

This presentation should not carry with it the possible stigma of the cry, "wolf, wolf" It is well then to make it clear that what I have to say is based on actual experience in the otolaryngological department of a large universtiy Rapid developments have made it difficult to maintain the moral and scientific integrity of the ear, nose and throat fields as a separate unit It actually poses the problem of survival, while administrative departments, concerned only with peaceful settlement of age-old disputes and the general surgeon's accusation of expansionistic tendencies, try to settle the differences I wish to record my own defense of otolaryngology as a head and neck specialty in medical educational programs My interest is actuated by the fact that this is not a local problem On the contrary, it concerns the worldwide acceptance of what reliably constitutes the specialty of otolaryngology I am not concerned whether we emerge victorious in this controversy but rather that the otolaryngologist and the general surgeon reach an amicable settlement Obviously, this would be for the good of medicine and surgery in general

Let us consider the situation in one of our largest medical schools The discussion concerned the dean of this medical school, the head of the department of surgery and the head of otolaryngology

The dean stated that the purpose of the conference was to try to settle those departmental difficulties wherein there seemed to be overlapping of activities He made it clear, however, that his own opinion was that recognition should be based upon the training, experience and ability of persons engaged in any endeavor

The head of surgery stated that otolaryngology, impelled by the restrictions of operative intervention caused by chemotherapeutic and antibiotic drugs, had felt the need suddenly to expand its activities by invading the field of general surgery He included plastic surgery and neoplasms with neck surgery as the main areas of expansion Furthermore, he stated that men trained in otolaryngology today would discontinue the practice of otolaryngology and represent themselves as specialists in plastic surgery and even in tumo surgery He admitted the lack of well trained men in this field among the general surgeons and stated that he had sent one of the members of his department to be trained in neck surgery

The head of otolaryngology called attention to the lack of knowledge of the historical phases of otolaryngology on the surgeon's part, and more particularly of the past record of the development of the department in the medical school The same disciplines of tumor surgery and maxillofacial surgery were in vogue when the medical school hospital opened its doors Members of the department of otolaryngology were leaders in contributions to the head and neck literature, and postgraduate students at the university were taught these subjects for the past two decades

It was pointed out that 1,700 hours of basic training in otolaryngology in this same medical school included approximately 600 hours or more in anatomy and morphology of the head and neck Did the general surgeon assume prior rights on the basis of equal training? By what authority did the general surgeon assume prior rights for claiming plastic (maxillofacial) surgery of the head and neck? Were not the original leaders in the field (Gordon New, Warren Davis and Ferris Smith, to mention a few) otolaryngologists? He reminded his colleagues that in the majority of schools and institutions of repute, plastic (maxillofacial) surgery is under the overall administration of the department of otolaryngology, in a few it is a separate department, and in others it is embraced in the dental school curriculum

The head of otolaryngology brought out in this conference the fact that 55 per cent of all neoplasms encountered in the tumor clinic of this medical school are of the head and neck He stated that most tumors (malignant) of the neck have their source in the pharynx or nasopharynx Is not the otolaryngologist, by training and experience, the logical person to treat these neoplasms? Is the gynecologist, the orthopedist, the neurosurgeon or the dermatologist expected to relinquish tumors in their respective anatomic fields to the general surgeon? He certinly is not, so why should the otolaryngologist?

The general surgeon will, without reluctance, allow that the otolaryngologist perform a laryngectomy, an admittedly formidable procedure Yet the general surgeon questions the right of the otolaryngologist to operate a thyroglossal duct cyst which traverses the hyoid bone, or a pharyngeal diverticulum, for which the otolaryngologist has developed a technique that permits a one-stage procedure

The otolaryngologist, as bronchoesophagologist, has contributed largely to the solution of medical and surgical problems of the chest He has trained chest surgeons and anesthesiologists in the arts of bronchoscopy Yet he has stood by meekly while the same forces, who have invaded this field, are the ones who cry out and seek to restrict further and isolate the otolaryngologist

It was brought out that the otolaryngological department in this medical school has a teaching program and, therefore, a responsibility for complete training of its students The Board of Otolaryngology requires of its candidates that they have a comprehensive knowledge of neck surgery and plastic (maxillofacial) surgery, in addition to the requirements of basic and residency training, therefore, a department of otolaryngology would be remiss in its function if it did not include these disciplines A knowledge of audiology, which includes speech and hearing, is also required of the candidate for certification By the same token, is the otolaryngologist to be denied this right because such subjects are given in courses of education speech, journalism, and the like, in some other colleges? Should the otolaryngologist be consistently denied the right to use short-wave therapy or coagulating currents because, after all, that is physical medicine? Should the otolaryngologist, or the neurosurgeon, be denied the right to perform fundoscopy or graph fields of vision because these tests fundamentally belong in the domain of the ophthalmologist?

Otolaryngologists stand by while the plastic surgeon, sometimes in the guise of the oral surgeon, takes his cut at a cleft palate, a maxillary sinus, a fractured nose, etc, frequently performed without good vision, only by palpation, and without the fundamentals or basic knowledge of the anatomy of these parts

As the conference continued, the head of otolaryngology stated further that a lack of a democratic attitude in medical education would be evident if dominance is to be established purely on sharply defined anatomical grounds, where, for example, the general surgeon would permit the otolaryngologist access to those tumors situated posterior to the posterior pillar of the pharynx By virtue of his training, is the general surgeon entitled to the special privilege of dealing with pathologic processes which involve these anatomic sites?

It seemed to the otolaryngologist that if this problem was to be considered from an administrative point of view, a qualified plastic (maxillofacial) surgeon with otolaryngological training, the time to devote to a busy otolaryngological service and to 100 hours of teaching otolaryngological postgraduate students and residents, should be appointed to the department of otolaryngology It does not seem rational that this man should have his appointment to the department of surgery Other departments have appointees who have their basic qualifications in entirely different but, nevertheless related fields The time of the plastic surgeon who works in the head and neck division is not dissipated in unrelated areas His otolaryngological associations and activities give him a background no other plastic surgeon possesses

In answer to the head of surgery, the otolaryngologist proceeded to say that the postgraduate students and their residents in otolaryngology receive a broad training As they do not know where their future activities may lead them, they must be provided with a thorough background Contact with specialists in time of national emergency has shown a glaring lack of a comprehensive training The fear expressed by the head of surgery that these men are going out into practice and represent themselves as tumor specialists or plastic surgeons is not supported by experience Bronchoesophagologists have become so only by special training in their field and only after they have completed their basic and residency training The same can be said in the other more specialized fields where residents in otolaryngology have gone further in their training to qualify themselves by virtue of special residencies and fellowships

The otolaryngologist made a plea for autonomy to allow for the individual department's needs He expressed the view that a department of otolaryngology under the administrative control of a department of surgery will be revealed as a department sterile of progress and stifled in its growth To be constructively helpful, he offered to the department of surgery training for their residents in the basic subjects of the specialty of otolaryngology He asked of surgery a similar cooperation in the training of prospective otolaryngological residents in the basic principles of general surgery The problem, he felt, must resolve itself on the basis of training and experience Narrow-mindedness has no place in its consideration The head of otolaryngology believed that the apparent differences implied in this conference were to be construed as a problem having national, if not international, significance He was concerned lest his medical college repeat the mistakes of the past, when personal and political differences and bigotry encouraged the rise of charlatans and quacks He desired that progress in medicine and surgery be enhanced by justifiable accomplishments! So did the head of otolaryngology conclude the discussion in hopes that his contentions would be supported

The initial conference resulted in a group of proposals submitted by the dean, specifically concerned with plastic surgery They follow

1 To set up a plastic surgery service — not a department

2 To be under the general charge of the department of surgery

3 The chief of service to be selected and appointed by head of surgery after consultation with heads of other surgical branches departments (otolaryngology ophthalmology, orthopedics neurosurgery)

4 That this chief need not always be from the department of surgery

5 That members of the faculty and staff appointed to this service are to serve under the general direction and supervision of the chief

6 That qualified physicians from all related departments are to be eligible in numbers to be determined by the medical director upon consultation with heads of departments concerned

7 That residents from all services concerned are to rotate through the service in a manner to be determined but without the necessity that all residents must so rotate and with the understanding that a certain resident from any proper service be given such service as to qualify him as a plastic surgeon as far as a residency is concerned It is recognized that in this training service emphasis may be placed on certain types of plastic surgery *i e* head and neck general etc but only on the basis of a sound general training It is expected that the number of such residencies willl never be large but will be so allocated as to give equable opportunity If possible a progressive pyramidal type of service should be provided partly to permit alternation of appointments

8 That clinical facilities *i e* beds are to be provided on the basis of a pooling of resources to provide such a service The dean further recommended that this include the facilities at the affiliated ear nose and throat hospital

9 That the service and this arrangement be correlated with certain aspects of the tumor clinic because of the important relation of cancer to plastic surgery particularly in the area about the head and neck

In conferences with members of his department it was apparent to the head of otolaryngology that in proposals from one to five, dominance of general surgery over surgery in a specialized area was to be administratively supported This was disquieting, because it is historically difficult to defend such extensions of authority While, on the one hand, it was believed that there was some administrative reason for this integration, it seemed to them more likely that it was the result of a personal aggression and personal pressure In proposals six through eight, there was reflected a better spirit of cooperation and encouragement of interests which are important to the specialty of otolaryngology Proposal nine has more to it than meets the eye, for the next attack might be to restrict the otolaryngologist in his efforts to deal with tumors of the head and neck Further comment on this particular point will be discussed later in this presentation

It was not evident what the disadvantage would be either to the patient or to the program of instruction to have the plastic surgery specialty continue to grow in its most congenial environment Certainly, in the case of maxillofacial surgery, it has been demonstrated in many institutions that distinguished surgery and teaching it provided in the department which gives the most immediate stimulation through identification with problems most characteristic of its interests Cleft palate is a case in point It may well be repeated that some of the best maxillofacial surgery in the field of cleft palate is provided for in a wide variety of professional environments Some is done in otolaryngology, some is done in dentistry, and some has been accomplished by plastic surgeons who function in a general surgical structure This same institution is now embarking upon a national program in cleft palate training It would be essential that whoever was responsible for the plastic work in the area would be sufficiently free to provide the necessary teaching time Experience in this area shows that men now working in the field of general surgery and who are interested in plastic work do not find themselves able or willing to contribute substantial portions of their time for this purpose From an educational standpoint, this does not seem to be sound

The proposals that the chief of the designated plastic surgery service should be "selected and appointed by the head of surgery" places the total direction and conduct of plastic surgery services in the hands of one department Here, assumption is that this general administrator would be sympathetic to all branches of application of plastic surgery Evaluated honestly, this does not seem to be the case in this and other institutions

It was not possible to determine from the proposals what the major evil consists of, nor was it clear for what purpose the proposals were designed On the face of the present issue, it appeared that the charge was merely one of "open encroachment" It may be possible to demonstrate that the present differentiated programs among departments produce an inferior service to the patient and poor teaching opportunity, but this did not seem to be the case in this particular medical school The members of the department of otolaryngology were unable to determine from the discussion of the initial conference what complaints of major character had been presented against the present system by the head of surgery, nor was it clear what a revision of the system would achieve by putting it under general surgery These, it seemed, were the major questions to be considered It would appear that one of the most important encouragements to further developments in the plastic surgery field was to be derived from the problems characteristic of the specialty There is reason to defend the thesis that plastic surgery is, at best, an expression of certain specialties, rather than being a specialty in itself

In proposal nine, dealing with the tumor clinic, the correlation and cooperation with the tumor service appear quite simple and feasible This, however, is not the case It forecasts other disagreeable experiences should tumor surgery come into a similar administrative orbit Ever since the tumor service began at this university hospital, the department of otolaryngology has been the sole division attempting close cooperation The net result has been that general surgery has resected such parts as external ears and noses Who will dispute the fact that these belong to the otolaryngologist? It is unnecessary to delve into the innumerable instances of a similar nature, reflecting the complete misinterpretation of surgical domain Whereas, as originally intended, the tumor clinic was set up as a consultative service, it now has become a competitive organization depriving other departments of needed material It is pertinent to this proposal that the chaotic state of affairs existing in a Veterans Administration hospital served by this same medical school be examined, because the very plan, as proposed by the dean, has been tried for several years How ineffectively such a plan functions is contained in the following facts, as drawn up by members of the otolaryngological staff They might prove of interest generally, *viz*

1 The tumor service is actually not a tumor service It is a head and neck service almost in its entirety inasmuch as the majority of the lesions occur in the head and neck

2 There has been no distinction made between otolaryngological tumors and what the surgery department states is general surgery The general surgeon has arbitrarily asserted that this is his rightful sphere of influence

3 The otolaryngological residents are better prepared in their knowledge of the neck than the general surgical resident Good neck surgery requires a complete understanding of the ear, nose and throat in all of its aspects

4 There is no question whatsoever that the present tumor organization is predicated upon the desire of the general surgeon to keep the ear, nose and throat specialist away from the external surgery

5 They agree that the otolaryngologist should do laryngectomies of all dimensions and yet they feel that thyroglossal cyst and pharyngeal diverticulum, etc, are in the sphere of action of the general surgeon We do not know by what law they arrive at this decision

6 Attending general surgeons are placed on the tumor service to obtain experience in head and neck surgery One would expect that they should be there primarily to teach No experienced otolaryngologist is welcomed as a surgical consultant to the tumor service This, apparently, is a further attempt to restrict members of the head and neck department and narrow the scope of their work

7 The tumor service organization as it presently exists, does not follow the dean s committee directive which states that the chief of the tumor service is to act in an advisory capacity Since the tumor service is, in fact, primarily a head and neck tumor service any man general surgeon or ear nose and throat specialist who is capable of performing head and neck surgery complete, should be in a consulting capacity It should not be a question of a particular patient belonging to general surgery or the ear, nose and throat Each consultant of a service should be apportioned a set number of beds with corresponding residents from each service

8 The otolaryngological residents have been used in the capacity of writing voluminous reports and preparing cases for surgery in which they are not even asked to participate The otolaryngologists examine the majority of these patients and determine the nature and extent of the lesion. The general surgeons performing the surgery have not participated in the work-up nor are they by virtue of their training and experience prepared to do so

9 The otolaryngological consultant has endeavored to give the general surgical residents opportunities for training better to prepare themselves for such work as concerns the head and neck tumors Reciprocal privileges have not been tendered to our residents

10 The otolaryngological service is the only one which jointly has attempted to work out its surgical problems whereas all other departments have taken unrestrictedly all cases in their domain and deny infringement of their rights to the tumor service

In the medical school under discussion notable progress toward a solution of the tumor problem was advanced when the hospital executive committee issued the following directive

"The intake division will assign new patients to the clinic to which they seem to belong — not to the tumor clinic For example a patient with a tumor of the skin will go to dermatology clinic, one with a probable bone tumor will go to orthopedic clinic, etc After the case has been worked up and before definitive treatment, the patient will be sent to the tumor clinic with a consultation request The tumor clinic recommendations will not be considered binding upon the doctors who assume responsibility for definitive treatment After definitive treatment has been completed the patient will be followed through the tumor clinic"

This constitutes a great step forward in that it sets up a tumor service as a central registry and follow-up division serving in a consultative manner, the ultimate disposition and management of tumor patients being left entirely to the various departments Whether or not the rightful domain of the otolaryngologist will be supported in this plan remains to be seen

CONCLUDING COMMENT

In the light of the foregoing remarks, it is fair to ask of ourselves Is otolaryngology progressing as a specialty? Are we still being considered as the group limited by a few mechanical operative procedures such as tonsil and adenoid and septal resection specialists? Is it not a fact that we are suffering from the errors of omission of some of our predecessors who called upon the general surgeons to tie off large vessels in the neck and complacently sat back while the men of vision in otolaryngology sought to elevate the standards of medical and surgical practice? We cannot assume responsibility for those men who emerged from short-time training periods and represented themselves as specialists, furthermore, we cannot subscribe to the philosophy of those timid otolaryngologists who would call for help because they do not wish to assume total surgical responsibility We can, however, with justifiable pride, call attention to the fact that as far back as 1916, the American Academy of Ophthalmology and Otolaryngology examined candidates for admission to membership and, in 1924, officially aided in forming the American Board of Otolaryngology It seems that there are men in otolaryngology who are able and willing to adhere to prescribed practices of elevated standards

We, in otolaryngology, have not remained static, but have achieved progress by thinking beyond the narrowed confines of cavities We have primarily been physicians seeking to bring better medicine and surgery to those who sought our help While we have profited from the contributions of those in the basic sciences and in medicine and surgery, our specialty likewise has contributed its share of scientific advancements Our responsibility lies in continuing such progress and by helping those entering the field of otolaryngology to become well-grounded and trained in the head and neck specialty The answer to those reactionaries who would thwart every effort on our part to present otolaryngology in all of its broadened aspects should be to offer superior advantages of training and experience to all those who desire to equip themselves in the modern way

Departments of otolaryngology should be autonomous They should have adequate budgetary allowances for service and teaching personnel Special services and clinics should be merely consultative without encroaching upon or depriving otolaryngological departments of material essential for adequate teaching The department of otolaryngology, on the other hand, should show its willingness to participate in the training of residents in other divisions, especially those in which there is unavoidable overlapping spheres of interest

This paper constitutes the third in a recent series of contributions on this subject In the first, which had to do with "Postgraduate Training in Otolaryngology," we sought to record the plan followed by us for special practice In the second, on "The Broadened Scope of Otolaryngology," we endeavored to show the fallacy of the general surgeon in assuming prior rights for all that he surveyed, pointing out that surgeons themselves decried the era of specialists in surgery of acute and chronic conditions of men, women and children In this present communication, we wish to uproot the evil from the very soil which nourishes it, the medical school We hope, thereby, to incite provocative thinking on the part of those concerned with the destiny of otolaryngology

Only from a sincere desire to see otolaryngology survive and progress, as it rightly merits, am I presenting the problems as they exist today It should be stressed, furthermore, that my interests are not motivated from the clinical side On the contrary, they are actuated from the teaching side, and only as they will benefit the younger generation of otolaryngologists and make them better doctors

1853 West Polk Street

VENTILATION PARACENTESIS FOR THE RELIEF OF STUBBORN EUSTACHIAN TUBE BLOCKAGE*

JOHN G MCLAURIN, M D,
Dallas, Tex

As far back as the seventeenth century, attempts have been made to restore hearing by removal of large or small portions of the membrana tympani, but it was not until the early part of the nineteenth century that Himly and Astley Cooper, working independently of each other, made artificial perforations of the eardrum and left some scientific information regarding their work They were encouraged by the favorable results thus obtained and recommended its practice by the profession It was only a short time before these men were convinced that the startling improvement obtained in some cases was temporary and the same degree of deafness recurred after the perforation had closed with cicatricial tissue It was to Himly's credit that he later advised the profession to stop the destructive procedure of removing large portions of the drum, but this practice continued in Germany and France for quite a while It seems that the poor final results were explained on partial or almost complete excisions of the drum membrane with often no regard for the ossicular chain, or on very small openings in the drum that invariably closed Later, in the early sixties of the nineteenth century, another wave of enthusiasm developed in this regard because of improved hearing obtained in many instances following incision or medium sized perforations made in the eardrum, but it was found that the drum opening would almost invariably

---

*Read at the meeting of the Southern Section American Laryngological Rhinological and Otological Society Inc Washington D C Jan 10 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 9 1949

close rather promptly and the improved hearing would be lost At that time, no efforts were made to keep the aperture in the drum membrane from closing

Politzer recognized the importance of equalizing the difference in the air pressure between the tympanic cavity and the external atmosphere by making an opening in the eardrum Though he did not state that there was a partial vacuum in the tympanic cavity in these cases, he did say that the opening in the drum should apply in all cases where the propagation of sound from the membrane to the stapes is interfered with I quote Politzer as follows "The pathological changes which indicate an opening in the membranes are *1* abnormal thickening and extensive, firm calcification of the membrane, *2* ankylosis of the malleus and incus owing to immediate or ligamentous union with the tympanic walls, *3* firm, irremovable strictures and adhesions of the Eustachian tube (Cooper), *4* intense and troublesome subjective noises, if they are due to stricture of the tube and cannot be alleviated by bougieing" It should be noted here that the third indication was that of firm, irremovable strictures and adhesions of the Eustachian tube and the fourth indication enumerated was intense and troublesome noises due to stricture of the tube that could be alleviated by bougieing Though he gives these as definite indications for paracentesis, he does not explain the mechanism by which the patency of the Eustachian tube occurs He goes on to explain that by making the artificial opening in the drum, the sound waves can directly reach the footplate of the stapes and thus be communicated to the labyrinth without the aid of the drum, malleus and incus He states that the operation can be successful only when the footplate of the stapes is movable, when the membrane over the round window is not thickened or calcified and when there is no trouble in the labyrinth He further advises various functional tests to determine activity of the auditory nerve and states that where sound perception through the cranial bones is absent or diminished, only slight improvement can be expected from an artificial opening in the drum Politzer made these small openings in the drum with a curved, pointed Galvano-cautery tip and found that the improvement in hearing was retained just so long as the drum perforation remained open. Various attempts were made to keep the opening from closing, such as the inserting of catgut strings, small fish bone plugs, lead wires, silver cannulas, small hard rubber pegs and small gold tubes, but all these proved unsuccessful, because they were expelled with or without a suppurative process, and the opening invariably closed.[1]

I have gone into the history of creating openings in the drum to improve hearing and relieve noises in the ear because I feel that it is correct and proper to give full credit to those men who did some work in this respect. Though I do agree there was merit in some of the work that these men did, I am now rather convinced that the real explanation of why they obtained some good results in some cases and why they did not obtain some permanent relief in other cases was not properly explained. Unless the cause of the deafness, tinnitus and sometimes nausea associated with vertigo are fairly well understood in these cases, surely the plan of relief is likely to fail. The tinnitus is the most difficult symptom to control, though in many instances it can be modified or almost cleared to the point that the patient is quite happy about it.

At this time it is well to review just a few points in the anatomy and histology of the ear drum, the tympanic cavity and the Eustachian tube. If a full discussion of the anatomy and histology of any one of the structures was attempted, the full time for this paper could be consumed, therefore, I shall mention only those points essential to this discussion.

Regarding the eardrum, it is important to remember that it has the three embryonal layers in it: the external cuticular, which is easily separated from the middle or fibrous layer, which in turn is covered by the tightly adherent mucous membrane layer internally. It is especially important to remember that the fibrous layer is confined to the membrana tensa and is composed of an outer layer of radiating fibres and an inner layer of circular fibres. The arrangement of the radiating fibres is similar to that of the spokes and hub of a wheel, the fibres being the spokes and the lower half of the malleus and umbo being the hub This means that at the hub the fibres come closely together, creating thickness, whereas near the rim or annulus they are widely separated The circular fibres are arranged in concentric circles around the umbo and are relatively sparse near the center of the membrane They are much more numerous in the periphery of the drum[2]

In the tympanic cavity, a few points are worthy of special mention as regards the subject under discussion The ossicular chain has the only system of movable joints in the body, the movements of which are not under the control of voluntary muscles Of all the movements in this chain, the most important one is that which occurs at the footplate of the stapes Unless nerve deafness exists, there is likely to be fairly good hearing as long as the stapedial footplate can move normally at the oval window The face and edges of the footplate, as well as the edges of the oval window, are covered with a very thin layer of cartilage The footplate is held in articulation with the oval window by the annular ligament which consists of elastic and connective tissue fibres that extend in a radiating direction, converging at the edges of the footplate These fibres are much longer at the anterior part of the stapes, which means that the annular ligament is much longer in front than behind This makes the movement of the stapes against the fenestra ovalis more or less like that of a hinge that opens in front

I wish to quote from Andrew Eggston and Dorothy Wolff as follows "The drum membrane is said to be 20 times the diameter of the oval window, but the energy transmitted to it is absorbed by the ossicular chain so that the amount received is probably only 10 times that impinging on the drum membrane"[4]

The tensor tympani muscle arising from the great wing of the sphenoid, the cartilaginous portion of the Eustachian tube and the osseous portion of the canal in which it is contained, inserts into the manubrium of the malleus at its base It is supplied by a branch of the mandibular nerve through the otic ganglion The sole purpose of this muscle is to pull the tympanic membrane medially and thus increase its tension

The stapedius muscle arises from a hollowed out cavity in the interior of the pyramidal eminence and its tendon is inserted into the posterior surface of the neck of the stapes It is supplied by the facial nerve and has the function of pulling the head of the stapes backward, which causes the base of the bone to rotate on a vertical axis drawn through its own center The back of the stapedial footplate is pressed inward toward the vestibule, while the front of the footplate is withdrawn from it By this action, the tension of the fluid in the internal ear is probably increased[1,3]

Most of the tympanic cavity is lined with simple nonciliated cuboidal epithelium As this membrane extends back through the aditus into the mastoid antrum, the cells become a simple squamous type In the hypotympanum and near the tympanic end of the Eustachian tube, the epithelium may be ciliated and according to Politzer, whose findings were confirmed by Manasse, there are varying amounts of glandular elements in the anterior part of the tympanum around the tubal opening There is no basement membrane but there is a subepithelial stroma The membrane is thin but it is thick enough to transport the small blood vessels, nerves and lymph channels[11]

Stimuli from various causes may create considerable edema and even the appearance of goblet cells In fact, metaplasia may be evident in instances of certain types of chronic irritation such as infection[14]

In the adult, the Eustachian tube is shaped like a trumpet at each end and is about 36 mm in length If the tube is healthy, the outer orifice is constantly open, but the pharyngeal orifice opens for a few seconds about once each minute The inner orifice is about 7 mm in its long diameter when closed and assumes the shape of an isosceles triangle, 6 mm in height and width when open The isthmus at the juncture of the osseous and membranocartilaginous portions of the tube is about 12 mm inward from the tympanic orifice and it has a calibre of about 4 mm in height and 2mm in width At the isthmus, the inner surface membrane is normally rather rough It is well to emphasize the fact that in the adult, the Eustachian tube runs upward and outward at an angle of 30 to 45 degrees off the horizontal There is a tendency to overlook this fact so that the tip of the cannula is turned more to a horizontal position, thereby making it appear that the tube is blocked The tube has rugae running longitudinally throughout the inner surface of its membranocartilaginous portion so that when the tube is open the rugae smooth out, but they do lie in longitudinal folds when the tube is closed The tensor veil palatini, innervated by the Vth nerve, is probably the only functional muscle of the tube and it acts to open the tube during the swallowing, yawning and sneezing reflexes The mucous membrane of the Eustachian tube is ciliated cylindrical epithelium which is much thicker and more loosely attached in the inner two-thirds of the tube The ciliated cells are interspersed with goblet cells The submucosa is abundantly supplied with lymph channels A mixed type of gland (both serous and mucus) is found rather abundantly in the submucosa of the inner third of the tube An organized type of lymph node, known as Gerlach's tubal tonsil is described as appearing in the Eustachian tube, but according to Wolff it appeared in only one out of 47 tubes sectioned and then in a child who had an otitis media In the presence of infection, organized patches of lymph cells are frequently seen[2,4-7]

In January, 1925, I first did a paracentesis on an eardrum in order to relieve a very stubbornly blocked Eustachian tube I have since used the term "ventilation paracentesis" to describe the procedure Prior to 1925, I had never done a paracentesis for the distinct purpose of creating patency in stubbornly blocked Eustachian tubes It was with trepidation that I did the first paracentesis for this reason alone, because I had always been taught in my otological training that the eardrum was hallowed ground and that one was not justified in opening the drum unless the drum itself indicated disease in the middle ear My boldness in doing this first ventilation paracentesis was based on the fact that I had observed that it was rare to find a Eustachian tube blockage when there was a perforated eardrum, regardless of what had produced the perforation I had further observed that the only instances of the tube being blocked while the drum was open were under one of the following conditions namely, *1* a tumor in the pharynx, whether benign or malignant, that obstructed the Eustachian tube, *2* where a very firmly formed stricture had developed in the tube, usually at the isthmus, probably resulting from a rather violent infection that had ascended the Eustachian tube from the pharynx, and *3* where there had been an adhesive type of middle ear infection that had created adhesions of the eardrum to the inner wall of the tympanum in such a way that the tympanic orifice of the tube did not open into that part of the middle ear chamber that was ventilated by the opening in the drum

Since January, 1925, I have used ventilation paracentesis on approximately 92 cases I have been agreeably surprised in about nine out of 10 instances to find that as soon as air entered the middle ear through the drum incision, the Eustachian tube inflated well with very moderate air pressure The exceptions to this have been mentioned previously As a matter of fact, in many instances where repeated bougieing has indicated a very tight resistant stricture, the tube has frequently inflated well as soon as the drum was incised It continued to inflate at subsequent treatments so long as the drum opening existed I have encountered instances in which I could pass a sound by what seemed to be a stricture and no air would enter the middle ear on efforts of inflation, and yet the inflation seemed quite normal as soon as the drum was incised Passing a sound may indicate that more than one stricture has been successfully dilated, but one or more of the strictures will tighten down within a minute or so after the sound has been withdrawn The tube may inflate well or poorly with a high squeak, only to close again in from a few seconds to two or three minutes

It has been my practice to dilate these tightly strictured tubes or those tubes that are generally tight throughout most of their length at intervals of five to seven days for six to 12 times before resorting to ventilation paracentesis Other measures, both local and general, were also taken to maintain patency of the tube This has been my practice because I thought it was the conservative attitude that one should take, but after reviewing some cases I have concluded that much time would have been saved for the patient if the drum had been incised earlier, however, time had not been squandered entirely because during that period when bougies were passed and the tube inflated at intervals with varying degrees of success, efforts were being made to clear up any pathology in the nose, sinuses, pharynx and throat In the past few years, radium therapy has been used where there seemed to be some hypertrophied lymphoid tissue in the pharyngeal orifice of the tube, furthermore, luetic infections had to be handled in some cases and there was always that possibility of neoplasm that one could not afford to overlook.⁷

A large number of these were hypothyroid cases and, therefore, had to receive thyroid therapy, which seemed to improve the chances for developing a patency of the tubes General metabolic disturbances received proper therapy Allergy was present in a large percentage of cases, so the usual measures to control it were adopted This has been more readily accomplished since the development of antihistaminic agents Prior to the advent of antibiotics, I occasionally followed an inflation with the passage of a wire Eustachian applicator of 1 to 2 per cent silver nitrate, hoping thereby to promote a gradual thinning out of the tubal mucosa Now I use weak sodium sulfathiazole or penicillin solution in these tubes with probably a greater degree of success in promoting a healthy state of the tubal mucosa

Deformed nasal septa, causing faulty air currents, compensatory hypertrophy of the turbinates and poor ventilation and drainage of the sinuses, can surely cause trouble in the Eustachian tubes in many cases, therefore, these deformities should be corrected by surgery Any of these measures may prove most essential in establishing a permanent patency in the tubes and must be carried out either before or after a ventilation paracentesis is done, my experience has been that in some cases all of the measures have failed to produce a patency of the tube, therefore, it became necessary to incise the drum For this reason, I have done ventilation paracentesis on approximately 92 cases

In a few of these cases only one incision was necessary, but in most cases three to six incisions were necessary, despite the fact that every effort had been made to keep the incision from closing by spreading the edges apart with a No 1 Bowman sound every two or three days In two cases, it has been necessary to make as many as eight incisions before the tube stayed open after the drum incision closed At this time I have only one drum that is still open and that one is in a young lady who had her drum opened by incision eight times Finally, a few months ago I incised the drum and then punched out along the line of incision This punched out opening is now about one-fifth its original size and will undoubtedly close I have never seen one of these openings fail to close As a matter of fact, I feel very certain that the drum should be permitted to close permanently when the thickening in the membrane and other soft structures of the tube has thinned out to the point that the tube remains patent after the drum opening closes In this regard, I do not agree with Politzer, who tried so many measures to keep the drum open and finally felt that he had failed in his efforts in such cases because he could not establish a permanent opening in the drum It is probable that Politzer was giving much more thought to the establishment of vibrations of the stapedial footplate by sound waves that came directly through the drum opening and was giving little thought to developing permanent patency of the tubes

It is true that in such cases where the tube has been closed the hearing is almost invariably improved by making a fairly large opening in the drum As a matter of fact, my patients have frequently requested me to keep the drum open for them because their hearing was better, vertigo nearly always relieved and tinnitus either gone completely or definitely decreased They learn from experience that when the drum closes before the tube has recovered to the extent that it will stay open their previous symptoms are likely to recur The drum, however, should be permitted to close after the tube has become healthy enough to stay open, otherwise if an acute cold supervenes there is considerable danger of infected material being blown from the pharynx out the tube, causing an acute otitis media I have seen this happen but have also noted that such an otitis media always clears promptly because of perfect drainage through the drum opening and a patent tube When the tube remains open after the drum closes, the patient is likely to complain of some loss of hearing and increased tinnitus at the time of drum closure, but hearing by air conduction will gradually improve and the tinnitus will probably become less noticeable

Prior to the opening of the drum, the patients on whom I did ventilation paracentesis complained principally of the following symptoms *1* a loss of hearing in varying degrees, *2* autophony, *3* tinnitus, *4* and in many instances vertigo, occasionally associated with nausea and vomiting when the vertigo is most marked The vertigo was relieved almost at once by ventilation paracentesis The hearing was improved in nearly every instance and the tinnitus either disappeared or was reduced to a point of tolerance I must admit, however, that the tinnitus is the most persistent of the symptoms mentioned, but that can probably be explained by the fact that tinnitus can be due to so many various causes My idea of what existed prior to paracentesis was a condition that was secondary to a primary blocking that had taken place in the Eustachian tube, probably the result of some acute infection or a part of the picture of catarrhal otitis media Of course, catarrhal otitis media can cover various types of trouble that occur in the middle ear and Eustachian tube When the tube became blocked and did not open after the infection subsided, then a partial vacuum developed in the middle ear, extending through the aditus to the mastoid antrum and to some extent involving all of the mastoid cells As a result of this partial negative pressure an edema was probably produced in the middle ear that extended to the mastoid cells The edema itself was capable of interfering with free movement of the ossicular chain and especially with the movement of the foot plate of the stapes at the oval window The vacuum in turn produced a definite tug on the membrane of the Eustachian tube at the point external to the constricted part, thereby intensifying the tightness of the tube Unless this vacuum could be broken by air getting into the middle ear, a vicious cycle would be established In other words, the blocked Eustachian tube created a vacuum which increased the tightness of the tube

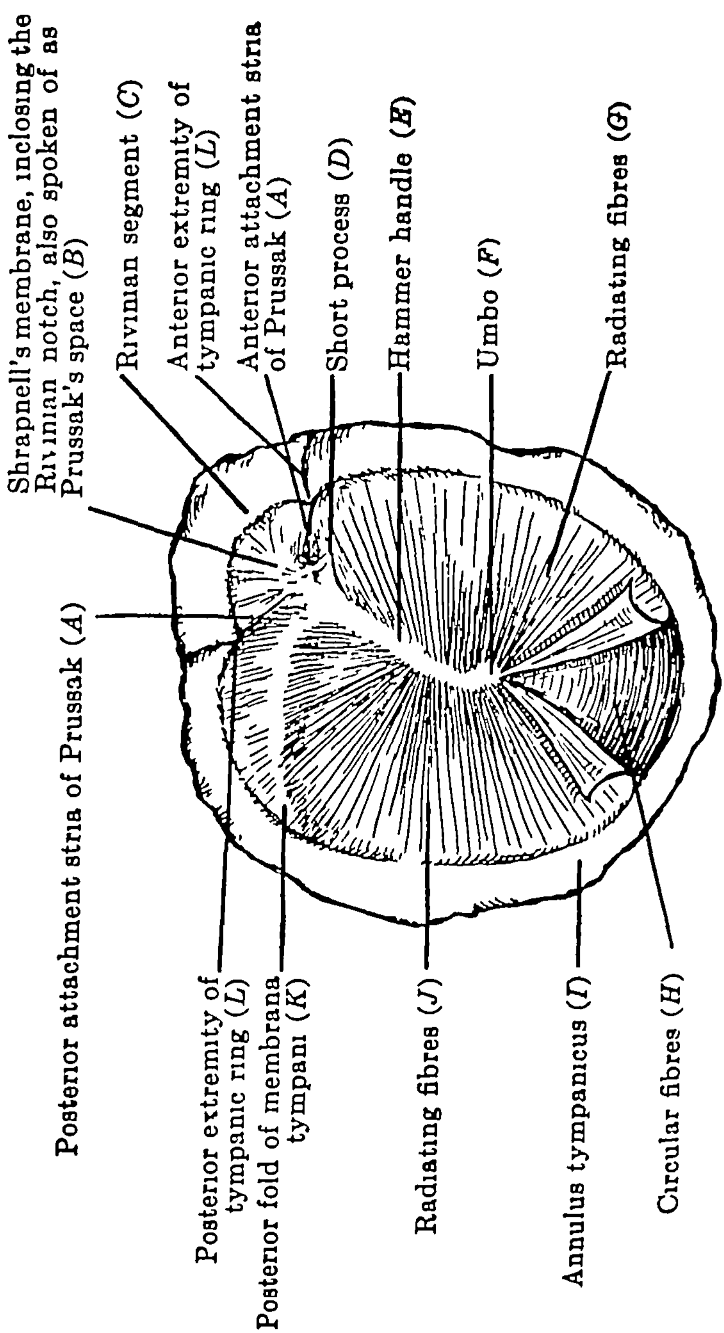
As mentioned before, I have in a few instances heard a short, high-pitched whistle at the time of incision As a rule, however, this did not occur because the difference in the air pressure on two sides of the drum was evidently more or less equalized by an effort on the part of nature to prevent a high degree of vacuum by developing enough edema in the middle ear to offset it It was perfectly logical to assume that there had also been enough edema around the footplate of the stapes and oval window to prevent the free movement of the footplate and there was probably enough edema to prevent the normal movements in the other joints of the ossicular chain, furthermore, there was surely an impairment of a prompt response on the part of the drum to sound waves striking its outer surface because of the difference in air pressure on the two sides of the drum Neither could the drum move as freely inward as it should because there was a fixed air pressure in the middle ear due to blocking of the tube

I did not do this ventilation paracentesis on any patients to relieve any special type of middle ear infection As a matter of fact, the fire of any previous infection was probably out in nearly every case where the procedure was adopted I was certainly not seeing the type of case that Dr Watt Eagle so excellently described in his paper entitled, "Secretory Otitis Media" and reported in the March, 1946, *Annals of Otology, Rhinology and Laryngology* The reason I state that these were not the cases on which I was doing this paracentesis is that there was no fluid level with or without bubbles in the fluid, and that in practically no instance have I found an escape of fluid through the drum opening that I made The condition that Dr Eagle describes was one that was probably the result of a virus disease with the formation of a thick, viscid fluid that frequently had to be removed by suction He reports 172 such cases and I have seen a few of these cases, but have felt justified in the past few years in giving adequate drainage by paracentesis because a fluid did exist in the tympanic cavity I have also used some suction through a low horizontal drum incision which I believe creates a better chance for the continuous escape of the viscid fluid that is rather typical of this type of secretory otitis media[8]

Dr James D McCall, of Mineral Wells, Tex, read a paper on Dec 3, 1948, at the meeting of the Texas Society of Ophthalmology and Otolaryngology at Fort Worth, Tex The title of his paper was "Secretory Otitis Media," but in conversation with him, he tells me that he intends to change the title to "Allergic Transudatory Otitis Media" He states that there are three stages of the disease, namely *1* stage of tight tubal blockage with a retracted eardrum, indicating vacuum in the middle ear, *2* stage of transudation of fluid in the tympanic space with no elements of inflammation in the fluid, *3* adhesive stage, due to slow absorption of fluid, leaving fibrin behind that causes crippling of hearing due to adhesions in the middle ear He makes a plea for early paracentesis in order to prevent the adhesive stage, and further states that there is little reason to fear secondary infection Since he feels reasonably certain that allergy is the etiologic factor, he attempts in every way to control the allergy and uses antihistaminic agents as valuable therapy[9]

Here again we find how valuable paracentesis can be in promoting patency of the tube and also in creating ventilation as well as drainage through the drum incision

Slide 1 This is a diagrammatic picture of the eardrum (Kerrison) Attention is called especially to the arrangement of the radiating and circular fibres that constitute the middle layer The circular fibres are much more numerous toward


Shrapnell's membrane, inclosing the Rivinian notch, also spoken of as Prussak's space (*B*)
Rivinian segment (*C*)
Anterior extremity of tympanic ring (*L*)
Anterior attachment stria of Prussak (*A*)
Short process (*D*)
Hammer handle (*E*)
Umbo (*F*)
Radiating fibres (*G*)
Posterior attachment stria of Prussak (*A*)
Posterior extremity of tympanic ring (*L*)
Posterior fold of membrana tympani (*K*)
Radiating fibres (*J*)
Annulus tympanicus (*I*)
Circular fibres (*H*)

Diagrammatic picture of the membrana tympani and its attachments

Sll 1 Diagrammatic picture of th ear lrum (K rrison) showing the arrangement of the circular and radiating fibres the annulus than in the region of the umbo, whereas the radiating fibres that are external to the circular fibres are much closer together near the umbo than at the annulus These points should be remembered because they have an influence on the shape of the opening created by incision of the drum

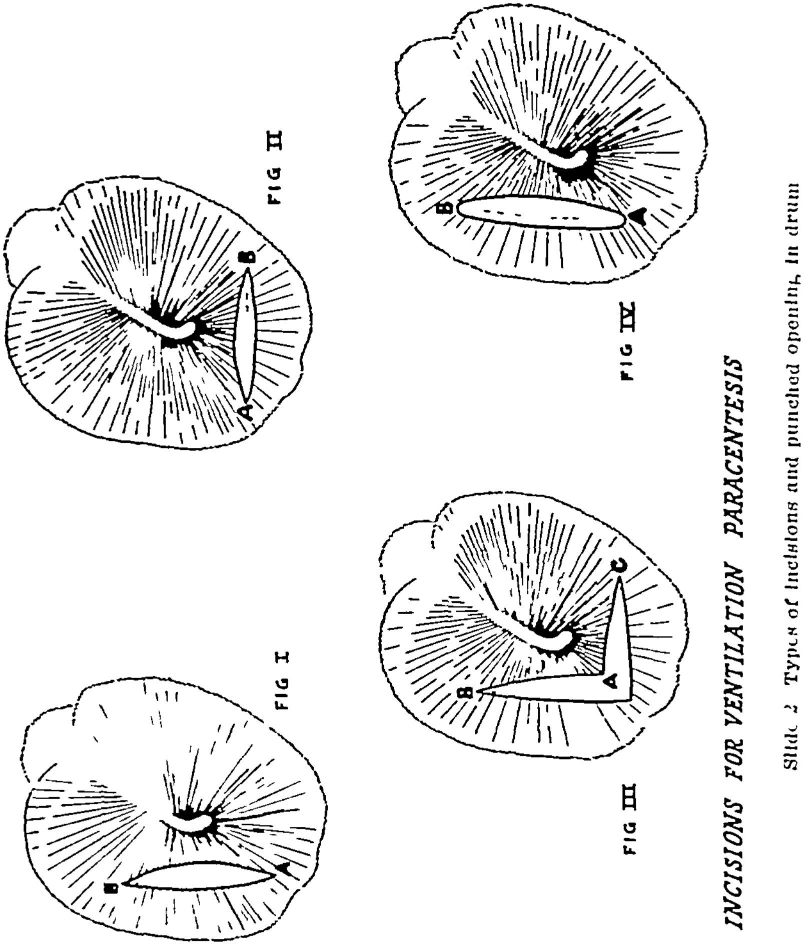
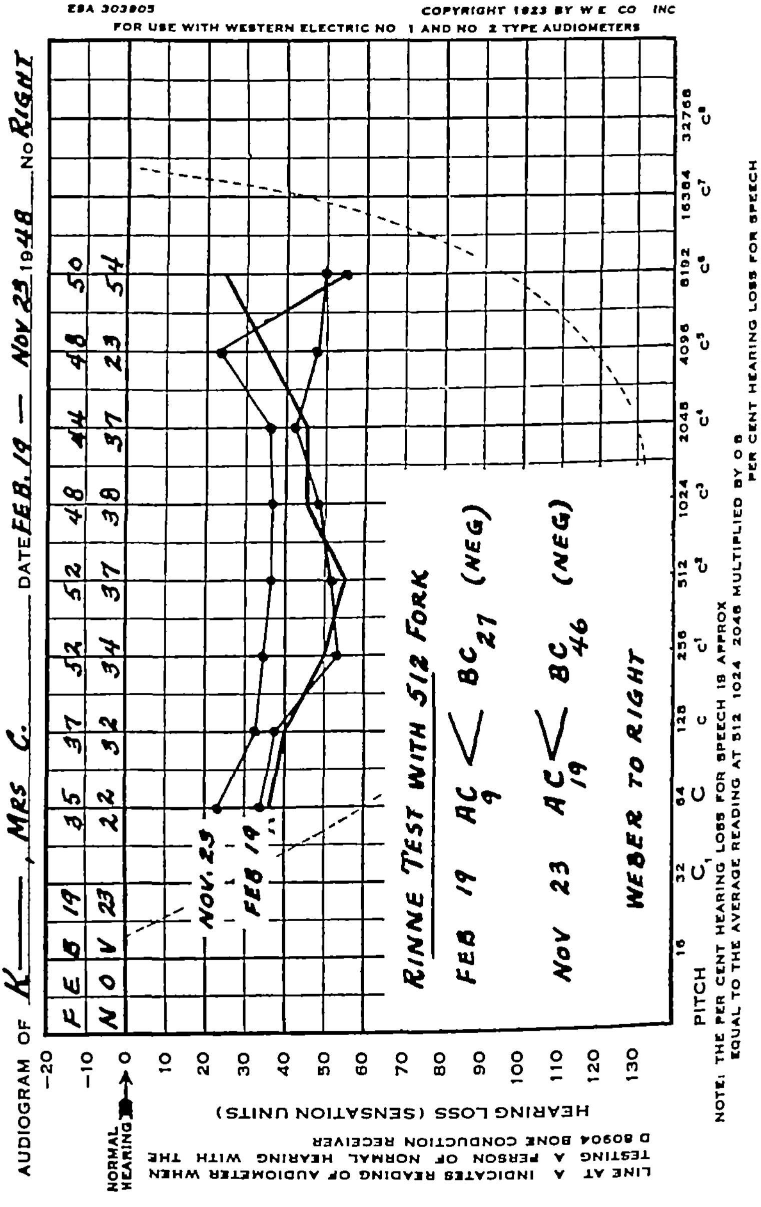


FIG I
A
B
FIG II
A
B
FIG III
A
B
C
FIG IV
A
B
INCISIONS FOR VENTILATION PARACENTESIS
Slide 2 Types of incisions and punched opening in drum

Slide 2 This shows the types of incisions and punched opening in drum Fig I shows circumlinear incision (A to

B) in lower posterior quadrant with more gapping toward the umbo due to pull of radiating fibres Dotted line is where incision was made Fig II shows straight incision (A to B)



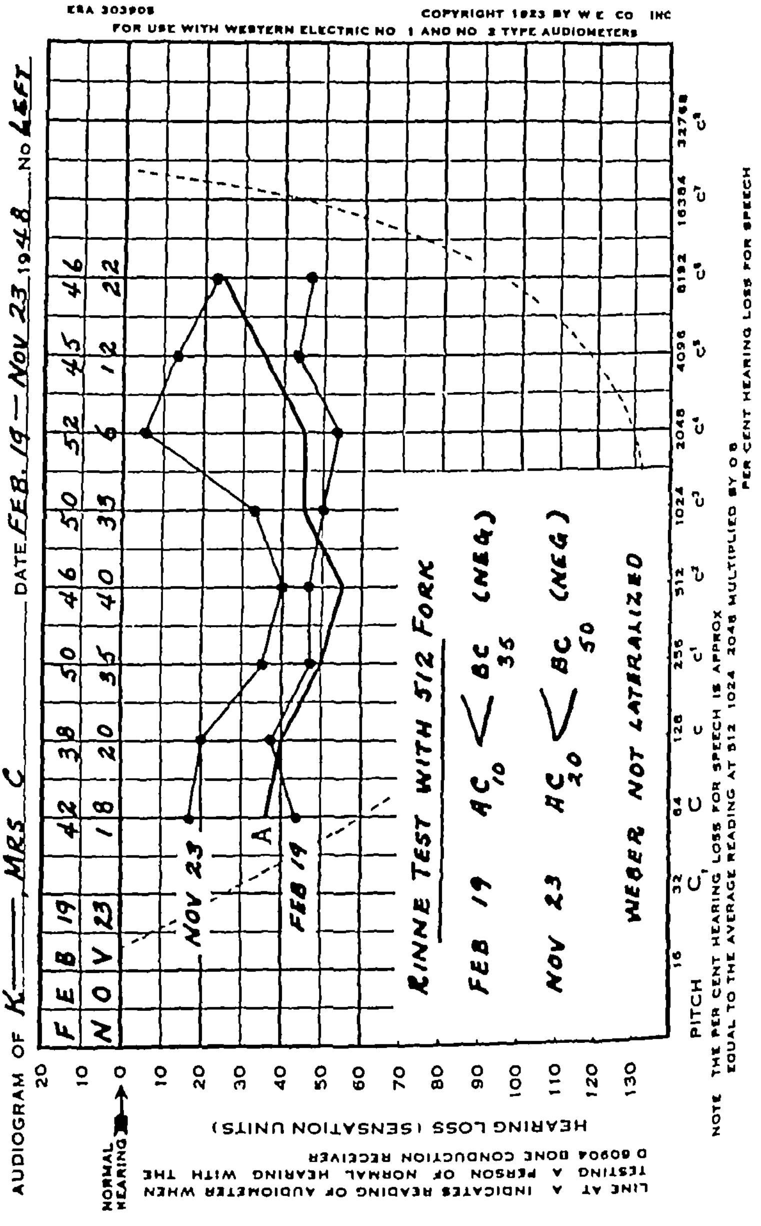
Slide 3 Audiograms of right ear on Case 1

across the lower portion of drum, gapping toward the umbo Stays open better than that of Fig I and also has advantage of better draining off of any fluid in the midle ear Fig III Angular incision (A, B, C) made by cutting from A to B and then from C to A Spreads open widely and stays open longer than that of Fig I or Fig II Fig IV Circumlinear incision from A to B, enlarged with punch forceps Stays open longer than any others described Somewhat more dangerous to make because of possible damage to ossicular chain due to poor chance of seeing how the punch is engaged This punched out incision is rarely necessary

Slides 3 and 4 show the audiograms on the right and left ears of Case 1

Mrs C K. age 48 Seen first on Feb 16, 1948, stating that deafness throbbing sound and tinnitus started in both ears rather suddenly about four years ago when she had a heavy postnasal discharge following an acute cold Stated very positively that she never had any trouble with hearing prior to that time Much heavy mucopurulent discharge seen in middle and superior meati of each side Stereo X rays of sinuses showed all sinuses clear except considerable blurring throughout entire ethmoid cell area of both sides B M R was 0 Vesperal temperature normal B P 110/65 Blood Wassermann normal Moderate amount of hyper trophied lymphoid tissue seen in each Eustachian tube orifice First cannular inflation of right Eustachian tube showed complete blockage Sounding of tube showed tight stricture in isthmus which was dilated and then air entered middle ear with a squeak No air entered left middle ear on first cannular inflation but sound showed tube tight throughout but apparently not strictured Cannular inflation with sounding and occasional application of 1 per cent silver nitrate throughout both tubes done 21 times at intervals of four to five days Proetz displacement treatments and Dowling tampons used alternately to help control ethmoiditis which did respond nicely to this therapy Radium applied to each orifice four times according to Crowe technique After all this therapy ears were apparently no better both tubes seemingly blocked to about the same degree as on first treatment.

On May 3 right tube completely blocked Incised drum and then tube inflated wide open without passage of sound Patient stated hearing improved at once and throbbing sound which was patient s own pulse disappeared Tinnitus much better One week later left drum incised and tube then inflated wide open Patient experienced same relief as on right side except that tinnitus was even more greatly relieved The improvement was maintained in each ear when the drums and tubes were open The right drum has been incised three times and the left drum twice The patient could hear normal conversational voice at 15 feet with the right ear immediately after the third incision but this was true of the left one after the first incision No fluid found in the tympanic cavity after any incision Both drums have been closed two months Left tube is wide open and hearing in left ear is quite satisfactory with no pulsations and very little tinnitus The right tube is not strictured



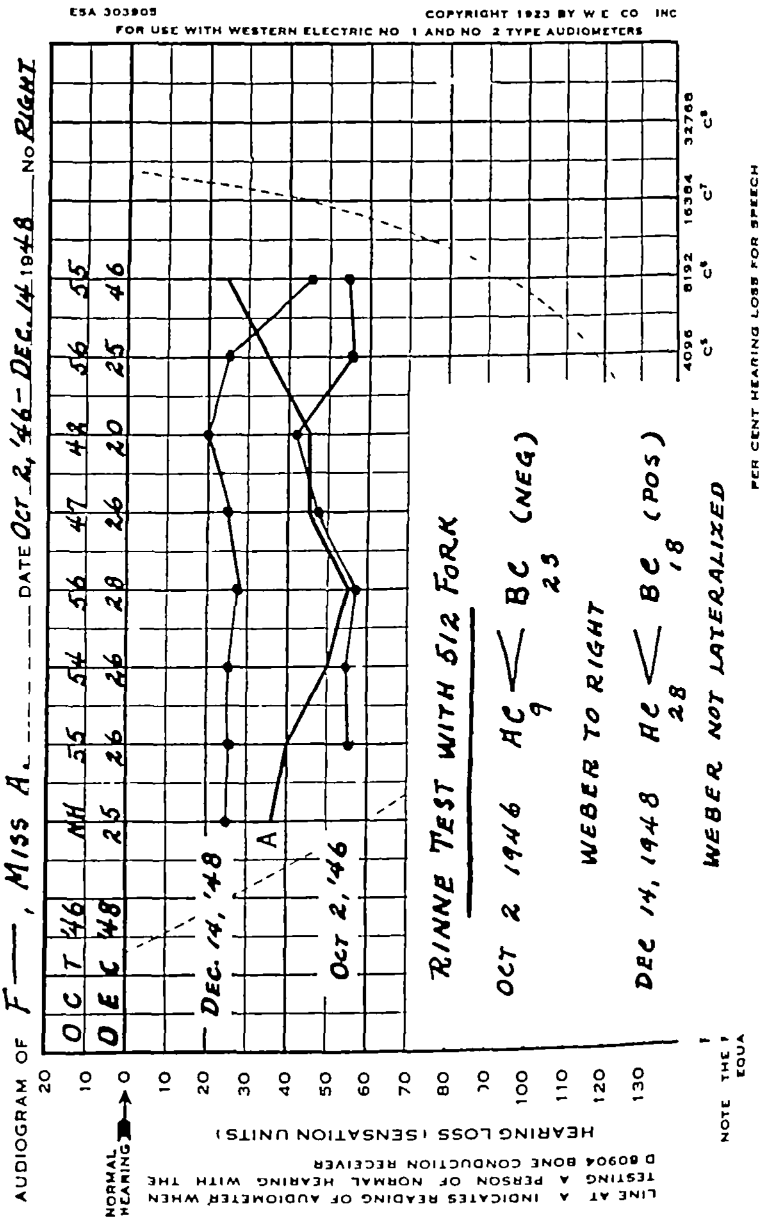
Slide 4 Audiograms of left ear on Case 1

now, but is not open freely at each treatment When it is open, patient does not complain of tinnitus and pulsations in that ear and hearing is satisfactory but when the tube is closed these symptoms with diminished hearing are present I think the right ear will require ventilation paracentesis one to possibly three more times, but as long as it will inflate at times, I am hesitant to reopen the right drum The patient is anxious for me to do so

It will be seen on these audiographic charts that this patient showed a marked improvement in her hearing from Feb 14 to Nov 23 1948, with the exception of a slight drop in hearing in the right ear in the high pitch of 8192 dv These charts show negative Rinne in each ear which probably means some fixation of the stapedial footplates but because of history of deafness audiographic curves and the findings of tightly blocked tubes with marked bilateral ethmoiditis it is doubtful that there is a true otosclerosis I really believe that the patient is mistaken about not having had any deafness until four years ago and that she probably does have a moderate degree of otosclerosis, but I m equally positive that the air conduction deafness did start about four years ago when the tubes became blocked In other words, this really is probably a mixed deafness but the air conduction deafness has been greatly relieved by ventilation paracentesis

Slide 5 shows the audiograms on the right ear of Case 2

Miss A. F age 30 Patient seen first on July 25 1945 with complaint that she had been dizzy for several days at a time for four months Had also been gradually losing her hearing in the right ear for several years Examination showed that she had chronically diseased faucial tonsils and a very badly deformed nasal septum She was advised to have her tonsils removed which was done in October 1945 She was also advised to have a submucous resection to help her in clearing a bilateral residual ethmoiditis but this operation has never been done At her first visit it was found that her right eardrum was retracted and the tube would not inflate until a stricture in the midportion was dilated The left drum was normal and the left tube was slightly sticky but dilated readily Proetz treatments were started twice weekly and the right Eustachian tube was treated each time A bougie was passed once weekly across the stricture in the right tube but the tube would invariably be closed when inflated with a cannula a few days later Inflations of right tube were attempted about 30 times without any apparent benefit I am not showing her earlier audiograms but only the one made on the day prior to the first ventilation paracentesis and the last one made on Dec 14 1948 No improvement in hearing was obtained prior to opening the right drum at which time the Eustachian tube promptly inflated wide open The patient immediately stated that her hearing was markedly improved She even called me by phone a few days later to tell me of things that she could then hear that she hadn t heard previously This marked improvement of hearing continued so long as her drum and tube were open but when the drum closed the tube would also block The drum was incised five times and the tube stayed open so long as air could get into the tympanic space through the incision Finally in October 1946 a circumlinear incision was made in the lower posterior quadrant but it was widened and extended downward and forward with a punch forcep This was followed after four or five days by a disturbance of taste on the right side of tongue that lasted to some extent for about three weeks I did not think that I had cut the chordae tympani nerve and felt reasonably sure that there must have been some postoperative edema around the nerve The hearing has been constantly satisfactory to the patient except on two occasions when she had an acute cold at which time some mucoid discharge came through the drum opening This



Slide 5 Audiograms of right ear on Case 3

has cleared promptly and the ear is perfectly dry now The drum opening is now just about 2 mm in diameter and I'm sure it will be closed when I see this patient again I want to repeat that I've never seen one of these openings refuse to close This young lady had a negative Rinne in the right ear when she was first treated but it is now positive There is a greater loss in the upper tones but this has also shown some improvement which makes one doubt that a real nerve deafness exists She does have some lymphoid tissue hypertrophy in the right Eustachian orifice but she has never agreed to have radium therapy These audiograms show a marked improvement in hearing in the right ear from Oct 2 1946, to Dec 14 1948, during which time the Eustachian tube has been kept open by ventilation paracentesis It should also be noted that the Rinne test which was negative originally is now positive a change which was hardly to be expected

CONCLUSIONS

1 Ventilation paracentesis has proved to be most valuable in relieving stubbornly blocked Eustachian tubes that did not respond satisfactorily to efforts of dilatation, inflation and other local measures, as well as to therapy to improve the general health of approximately 92 patients

2 The procedure is a safe one and the drum will invariably close with no apparent damage to it The drum should finally be permitted to remain closed when the tube regains a healthy state

3 As a rule, there will be an improvement in air conduction hearing, relief of autophony, control of vertigo if of a type that is associated with tubal blockage, and relief or some improvement of a co-existing tinnitus

BIBLIOGRAPHY

1 Politzer, Adam Diseases of the Ear Eng trans 5th ed London Balliere Tindall and Cox 1909

2 Kerrison Philip D Diseases of the Ear 2nd ed Philadelphia and London J B Lippincott Co 1921

3 Gray Henry Anatomy of the Human Body 23rd ed Philadelphia Lea and Febiger 1936

4 Eggston, Andrew A and Wolff, Dorothy Histopathology of the Ear, Nose and Throat 1st ed Baltimore The Williams and Wilkins Co 1947

5 Tremble, G Edward Eustachian Tube *Arch Otolaryngol* Aug 1947

6 Rich, A. R A Physiological Study of the Eustachian Tube and Its Related Muscles *Bull Johns Hopkins Hosp* June 1920

7 Hill Frederick T Problems of Diagnosis in Obstruction of the Eustachian Tube *Ann Otol Laryngol and Rhinol* June 1948

8 Eagle, Watt W Secretory Otitis Media *Ann Otol Laryngol and Rhinol* Mar 1946

9 McCall, James D Secretory Otitis Media Read before the Annual Meeting of the Texas Society of Ophthalmology and Otolaryngology on Dec [illegible] 1948 Fort Worth Tex

SUBCUTANEOUS RUPTURE OF TRACHEA FROM LARYNX BY EXTERNAL TRAUMA, WITH STENOSIS AND RECOVERY *

B R DYSART, M D ,
Pasadena, Calif

On Jan 8, 1947, I was called to see a boy of 15 who was having difficulty in breathing About 30 minutes before, while riding a motor scooter out of an unlighted parking lot, he had run into a chain stretched across the entrance The chain had caught him across the neck and thrown him off the scooter He could breathe fairly well while sitting with his chin held well up He had coughed up a little blood, could talk only in a whisper, and there was very sharp pain on swallowing

CASE REPORT

Examination showed no laceration of the skin, swelling over the larynx was moderate, and there was no crepitus Extreme tenderness prevented careful palpation The larynx was easily inspected with a mirror, and there was no movement of the cords on breathing or phonation The cords were open at about 15 degrees, and a little fresh blood was seen streaked over the left cord A diagnosis of probable dislocation of the laryngeal cartilages was made and the patient was admitted to the Huntington Memorial Hospital

A little oxygen was given at intervals, and he got through the night very well At seven o'clock the next morning he was no worse, but still there was no motion of the vocal cords At noon, 15 hours after the accident breathing was worse and tracheotomy was decided upon

As usual, a bronchoscope (7 mm) was passed to insure a good airway during the procedure A little below the cords the scope entered an area filled with blood clot and the lumen of the trachea was found with dif

---

*Read at the meeting of the Western Section American Laryngological Rhinological and Otological Society Inc Los Angeles Calif Jan 30 1949

†From the Department of Otolaryngology School of Medicine University of Southern California Service of Dr J Mackenzie Brown

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 10 1949

ficulty The scope was passed down to the bifurcation and a few blood clots were sucked out. After injection of 1 per cent novocain incision was made and the trachea was found to have been torn completely away from the larynx with a separation of an inch or more The tear was transverse and occurred just below the cricoid cartilage The tracheotomy tube was placed as low as possible In order to keep the edges in good position and to prevent stenosis a section of rubber tubing was left inside the trachea The trachea was sutured back to the larynx with three strands of No 1 chromic catgut The intratracheal tubing was a section of rubber urethral catheter the largest size that could be inserted without pressure In order to hold it in place a suture of chromic gut was passed through the tube and the torn edge of the trachea

Intranasal feeding was done for a few days and then patient swallowed food without much difficulty In spite of penicillin there was some bronchitis Dr Jesberg and Dr Alden Miller were consulted and it was decided to take out the intralaryngeal tube in three weeks This was done by passing a laryngoscope and grasping the upper edge of the tubing At first the breathing space was good but in two weeks stenosis had occurred to the point of almost complete closure It was decided to keep the strictured area dilated with rubber sections passed up through the tracheotomy wound following technique developed by Dr Jesburg[1] He was turned over to Dr Alden Miller who has done a great deal of this work with Dr Jesberg

It was impossible to dilate the stricture sufficiently with retrograde bougies and rubber tubing sections so tracheostomy and removal of the scar tissue was done on April 8 1947 The scar was narrow and dense and located just below the cricoid cartilage After excision of the scar a rubber tubing size 34 French was inserted and anchored to the tracheotomy tube The tubes were changed every two or three weeks and finally left out six months after the injury Three weeks later he developed a case of bulbar poliomyelitis that was almost fatal He recovered however with no residual paralysis On Nov 10 1947 the tracheotomy tube was removed and later the wound was closed

There has been no return of motion of the vocal cords The voice is a rough whisper The cords are fixed with arytenoids about 4 mm apart and there is adequate airway

COMMENT

The tendency for injuries of the larynx and trachea to stenose is well known The same tendency is present in complete lacerations of the ear canal and of the nose These injuries must be kept open with some form of dilating material Rubber tubing is rather irritating and cannot be left in place much longer than two weeks Acrylic molds made of dental plastic require time and a special laboratory for their construction If a similar case were encountered, I would try to obtain a piece of plastic tubing of the proper size and leave it in place for six months It has occurred to me that the intratracheal tubing, of plastic material such as the anesthetists use, would be an ideal material and would be on hand in most hospitals in different sizes This could be anchored to a tiny ring soldered to the back of the tracheotomy tube as described by Jesberg It would then be unnecessary to leave the wound open as widely as is advised by Erich in using his special acrylic mold of dental compound

Several unusual features were present in the above case. In spite of the complete rupture of the trachea, there developed no subcutaneous emphysema The fact that there has been no return of motion of the vocal cords indicates injury to the recurrent laryngeal nerves It is possible that nerves were torn away from the larynx by the wide separation of the torn parts In spite of the extensive damage, there was not enough bleeding to cause much coughing or choking The extent of the damage was not suspected until the incision for tracheotomy was done

There have been only a few reports of rupture of the trachea or bronchi without laceration of the skin In none of the cases was an actual complete rupture seen and verified, but it is probable that it did occur in some of the cases reported

Holinger[2] read a paper at least year's meeting of the American Laryngological, Rhinological and Otological Society, Inc, in which he described three cases with sustained rupture of one of the main bronchi due to external chest trauma, two of which cases were children five and six years of age In all of them complete stenosis developed In two of his cases removal of the completely atelactatic lung was done It was not possible to dilate the strictures He mentioned that R A Daniel had in press a report on successful experimental repairs of ruptured bronchi with glass, metal and plastic material

Foster[3] reports a case that sustained a rupture of the trachea just below the cricoid from a glancing blow over the chest He rapidly developed massive emphysema from his forehead to his knees He was suffocating when an emergency tracheotomy was done He recovered, but developed stenosis just below the cricoid

Cummings[4] reported a case of rupture of the trachea caused by the patient being thrown forward against the back of the front seat of an automobile This case developed emphysema from the lower face to the midchest, but did not have a tracheotomy done until the next day Stenosis developed just below the cricoid

Erich[5] has described the method he has developed at the Mayo Clinic for the treatment of tracheal or laryngeal stenosis After excision of the scar by open operation, the raw area is skin-grafted and a rubber sponge left in the trachea for 10 days A mold is then made of dental plastic material and left in place for six months This method was described again at the last College of Surgeons' meeting in Los Angeles by Erich

SUMMARY

A case of rupture of the trachea with wide separation of the trachea from the larynx is reported The literature for the past 10 years is summarized

BIBLIOGRAPHY

1 Jesberg Simon Treatment of Cicatricial Stenosis of the Larynx *Trans Amer Laryngol, Rhinol and Otol Soc. Inc* 410-413 1937

2 Holinger Paul H Zoos Albert R and Johnston Kenneth C Rupture of Bronchus Due to External Chest Trauma The Laryngoscope. 58 817 833 Aug 1948

3 Foster John H The Management of Cicatricial Stenosis of the Larynx. *Ann Otol, Rhinol and Laryngol*, 48 643-648 Sept. 1939

4 Cummings George O Atresia of Trachea Following Injury Dilitation with Core Molds *Ann Otol Rhinol and Laryngol* 49 801 804 Sept 1940

5 Erich John B Treatment of Extensive Stenosis of the Larynx or the Trachea. *Arch Otolaryngol.*, 41 343-350 May 1945

SCLEROMA OF THE LARYNX, TRACHEA AND BRONCHI *†

ALDEN H MILLER, M D ,
Los Angeles, Calif

Scleroma is a chronic infectious granulomatous disease of the respiratory tract The first reports of this disease described lesions in the nose, and thus the term rhinoscleroma was given to it In these early papers the process was always considered to be primary in the nose The first cases were reported by von Hebra in 1870, and in 1882 von Frisch discovered and described a Gram-negative bacillus occurring in the nasal secretions and involved tissues of patients with this disease This organism, Klebsiella rhinoscleromatis, is still listed as the bacillus of Frisch and is considered by most students of this disease as its cause It was soon established that the diease can extend or can probably primarily involve any part of the respiratory tract In 1932, the International Congress of Otology, Rhinology and Laryngology at Madrid, Spain, officially adopted the term scleroma [10] There now have been many cases reported and many excellent descriptions of the disease as it affects the nose but few describing constant or typical laryngeal involvement and very few describing the lesions produced by scleroma in the bronchi For this reason three recent cases from the Los Angeles County General Hospital are being reported as they illustrate common findings in

---

*Read at the meeting of the Western Section American Laryngological Rhinological and Otological Society Inc Lost Angeles Calif Jan 30 1949

†From the Department of Otolaryngology University of Southern California School of Medicine

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 7 1949

the larynx, trachea and bronchi, and because all three of these cases were treated with streptomycin with interesting results

INCIDENCE

It was first thought that the disease existed only in southern Europe, but it is now known that while not common it may be found anywhere and in probably any nationality It is endemic in the Balkan states and thousands of cases have been reported from that area Laryngeal scleroma was first described by Gerhardt in 1876 Watkins,[11] in 1921, reported the first case of scleroma in this country in a native American and described it as being primarily of the larynx and trachea The first case recognized in California was reported by Alderson[1] in 1914

The disease occurs almost equally in both sexes and at almost any age, but with the greatest incidence between the fifteenth and thirty-fifth year Poor hygiene seems to be a factor as by far the greatest number of patients seem to have a background of uncleanliness or poor sanitation

PATHOLOGY

Grossly the lesions are usually described as being of an indurated, infiltrative nature, causing granulomatous submucosal thickening and stenosis of air passages Szmurlo[9 10] classifies the lesions into a discrete nodular type and a diffuse infiltrative type and describes three stages in their development

1 First, a diffuse stage with early infiltration of the submucos and atrophic changes in the mucosa In this stage there is secretion of foul smelling discharge and much crust formation It is felt that this early stage of scleroma is many times confused with and misdiagnosed as atrophic rhinitis with ozena Dr Wexler, of our ear, nose and throat department, re-examined 27 patients who had during the one year, 1947, a clinical diagnosis of atrophic rhinitis and revealed positive biopsies and cultures for scleroma in seven of these patients

2 The second is a circumscribed stage in which there is first a discrete small nodular infiltration emerging from the surface and in which there may be only one nodule present Soon a large number of nodules coalesce into large granular, firm masses which are so hard that they give the feeling of cartilage This more diffuse granulomatous process may present large granulomatous masses which may be seen either *a* extending widely throughout the submucosal area, or *b* thinning and elevating the mucosa so that there is marked encroachment upon the air passages Usually the mucosa is intact and rarely is there ulceration unless there has been trauma to the lesion

3 The third stage is a stenotic, fibrotic stage in which connective tissue infiltration replaced most of the submucosal diseased area and a concentric stenosis is usually present. Here, too, the mucosa is usually intact and smooth, although many times injected and indurated

Putschowsky[3] would further divide the above second stage into two parts An early soft stage of indefinite granulation tissue, and later cartilage-hard phase when foam cells and hyaline bodies are present

Microscopically, a characteristic picture is described by all writers Overall, the picture is that of a granuloma There is papillary hyperplasia and hypertrophy of the surface epithelium Beneath the epithelium the lamina propria is trabeculated and intensely infiltrated with many plasma cells and the large foam or Mikulicz cells These Mikulicz cells, supposedly characteristic of scleroma, have centrally placed nuclei around which the cytoplasm is divided into large, empty compartments giving the cells their "foamy" or "lacy" appearance Within these large vacuoles are found the bacilli of Frisch, the invasion by which causes the vacuolation There is usually present another characteristic cell, the so-called Russell bodies, which are plasma cells with an excentrically placed nucleus and a cytoplasm which stains intensely with eosin This typical histological picture of scleroma is best found during the second or "hard" infiltrative stage In the early or atrophic stage, the Mikulicz cells and Russell bodies may not have appeared, while in the third stage there is an increase of fibrous connective tissue and a diminution in the number of specific cells and bacilli

BACTERIOLOGY

Not everyone agrees that the bacillus of Frisch is the etiological agent, although it is almost always cultured in this disease Figi and Thompson[5] and Cunning and Guerry[2] agree with some of the earlier workers that this bacillus is a secondary invader and is found in other diseases as leprosy, glanders and bubonic plague, however, Levine and Hoyt[6] are convinced from their experimental studies that the bacillus of scleroma is not found in the normal nose or throat and that it can be isolated in all cases of scleroma and has a characteristic cultural pattern The same opinion was held by Lasagna in 1925

SYMPTOMS AND FINDINGS

The three case reports will serve to illustrate the symptoms and findings usually found in scleroma involving the larynx, trachea and bronchi and to introduce the subject of treatment

Case 1 R T a 17 year-old Mexican female born in southern California first appeared at the Los Angeles County General Hospital on April 27 1936 because of difficulty in breathing A large granulomatous mass in the anterior commissure of the larynx was clinically diagnosed as papilloma removed and the biopsy reported as an ulcerated benign polyp

In June of 1936 a total of 3 000 r of deep X ray therapy by the Coutard method was given to the larynx because of much thickening of the anterior half of both true and false cords

In September 1936 a diagnosis of atrophic rhinitis and pharyngitis was made

In January 1941 a diagnosis of asthma was made in the out patient clinic and in February 1941 the patient was hospitalized for a time with the diagnosis of bronchopneumonia

On Sept 21 1942 the patient was readmitted because of increasing difficulty in breathing for the past nine years No relief was obtainable with epinephrine There were signs of right upper lobe bronchus obstruction and consolidation in the right upper lobe Bronchoscopy revealed the larynx to be normal except for reddening and thickening of the true cords but their movement was restricted so that the bronchoscope could barely be passed Beneath each cord was a granulomatous like thickening and the entire tracheal lumen was narrowed so that the scope was not passed Following a course of sulfadiazine therapy, the patient was rebronchoscoped one month later on Oct 9, 1942, at which time there was less thickening of the mucosa of the larynx and trachea but the right main bronchus was completely obliterated by what appeared to be a fibrotic scar with numerous small perforations suggesting a sieve This obstructing tissue was very firm but did not bleed A partial airway was established by biting it away It was reported as chronic inflammatory tissue Breathing was improved, and the patient did not reappear for three years

Bronchoscopy on May 15, 1945, revealed only slight injection of the larynx and trachea, but the right main bronchus was greatly stenosed for a distance of 1 cm below the level of the carina, with one central opening and many sieve-like perforations The left main bronchus was almost completely stenosed about 1 cm below the carina, with only a slit like opening remaining Attempts at biting away this stenotic tissue and dilating the bronchial lumens was repeated with great improvement in breathing until October, 1945, when bronchoscopy revealed stenosis extending into the lower lobe bronchus on the right and into the divisions of the main bronchus on the left

Bronchoscopy on Jan 11, 1946, revealed the glottic chink to be stenosed by slight diffuse infiltration The mucosa over the carina and extending down both main bronchi was markedly thickened but smooth and pale A clinical diagnosis of scleroma was made at this time, but the biopsy was reported as squamous metaplasia

Repeated biopsies of the diffusely infiltrated bronchial mucosa were negative for evidence of scleroma, but on April 26, 1946, a biopsy from the thickened mucosa obstructing the left nares was described as presenting a picture highly compatible with that of rhinoscleroma, showing a dense infiltration of plasma cells, many Russell bodies very many large foam cells of the Mikulicz type, in which even with the H E stains bacilli could be seen clustered and surrounded by large vacuole-like capsules

On May 6 1946 Klebsiella rhinoscleromatis was identified by culture reactions from nasal smears A sensitivity test of this organism with streptomycin was made and treatment was started on May 23, 1946 consisting of one fourth gram every three hours intramuscularly and one twentieth of a gram every three hours by nebulizer Three days later there were no organisms and no growth from smears and cultures taken from the nose The treatment was discontinued after 10 days when a rash developed on the patient's arms and abdomen There was marked improvement in breathing

The patient was not seen again for seven months until Jan 17 1947 (during which interval she underwent a normal delivery of her fourth child) On examination the larynx then appeared normal but the glottis seemed small and tight The tracheal mucosa was dry but smooth and not infiltrated The mucosa over the carina and of the main bronchi was slightly thickened but smooth All bronchial openings seemed narrowed a very little and there was one vertical pillar of scar like tissue in the left main bronchus just above its bifurcation The impression was that the process was not only arrested but that the bronchi were very much more open than they had ever appeared Repeated bronchoscopies in March and October 1947, revealed the bronchi still well open

The last bronchoscopy was performed on Nov 26 1948 at which time the patient complained of slight dyspnea upon exertion The larynx trachea and carina appeared normal The right side of the tracheobronchial tree seemed normal except that all lumens had been narrowed about 10 per cent by mucosa thickening The left side of the tracheobronchial tree was the same except that the medial wall of the main bronchus had one area about 2 cm below the carina where the mucosa presented a small granuloma like nodule and a band of scar tissue

Case 2 A 26-year-old male alien Mexican itinerant prune and cotton picker was first admitted to the Los Angeles County General Hospital on Sept. 19 1946 because of cough and increasing respiratory difficulty for the past four months Within five days stridor and dyspnea increased so greatly that an emergency tracheotomy was necessary on Sept 24 1946 Direct laryngoscopy at this time revealed only slight thickening of the true cords but there was a large amount of deep red granulomatous like thickening of the subglottic tissues which bled easily when traumatized by the scope The mucosa of all of the rest of the trachea was smooth but greatly thickened so that its lumen was greatly diminished in size Two days later examination of the nose revealed granulomatous appearing tissue on the anterior end of both inferior turbinates and on the right side of the septum anteriorly

Biopsy taken from the trachea on Sept 24 1946 was described as being granulation tissue cover on one surface by epidermoid epithelium and infiltrated with many plasma cells some of which were vacuolated and others which resembled Russell bodies Smears taken from the nose on Nov 4 1946 were positive for Klebsiella rhinoscleromatis by cultural reaction Their streptomycin sensitivity test revealed no growth with 1 5 mgm per milliliter A sulfadiazine sensitivity test revealed only slight inhibition in a 5 mgm solution but no complete inhibition in 40 mgm per cent soluton The penicillin sensitivity test revealed no inhibition in the 100 unit solution Re-examination at this time revealed the glottic structures to be normal but the immediate subglottic area and upper trachea was almost completely stenosed by fairly smooth surfaced deep purple-red infiltration of all of its mucosa

On Nov 23 1946 streptomycin therapy of 1 gm daily in eight divided doses intramuscularly and half a gm daily by nebulizer was instituted and repeated for 14 days

The tracheotomy tube was removed on Jan 13 1947 and on Jan 21 1947 direct laryngoscopy revealed the larynx to be injected but the infiltration previously seen subglottically was completely absent The tracheal mucosa was smooth and only slightly thickened as its ringed structure could plainly be seen The tracheobronchial tree was completely normal The patient was discharged on Feb 18 1947 and has never returned

Case 3 H P a 22 year-old Mexican born in southern California, was admitted on March 5 1947 in a critical condition He was cyanotic and had stridor and marked retractions A history was obtained of increasing respiratory distress for the past four years Direct laryngoscopy revealed the larynx to be injected and the true cords slightly thickened but the glottic chink wide open The subglottic region was completely filled by a dry crust-covered lesion Immediate tracheotomy was necessary Smears and cultures were suspicious for diphtheria and 40 000 units of diphtheria antitoxin were given Throat cultures remained positive for diphtheria until April 19 1947 The patient was transferred to the nose and throat service on April 28, 1947, because of inability to decannulize him On examination typical odor of ozena was detected Both naris were completely occluded by foul smelling adherent crusts covering thickened infiltrated mucosa Indirect laryngoscopy revealed crusting and dark red thickening in the subglottic area

On May 16, 1947 tracheoscopy was unsuccessful because of great thickening of the tracheal mucosa covered with crusts, and because of bleeding when the crusts were removed On May 23, 1947 the mucosa of the trachea, carina and the beginning of both main bronchi were greatly thickened and the bronchial lumens were so stenosed that they could not be entered by the bronchoscope The mucosa appeared very dry and slightly roughened

On June 2, 1947, repeated biopsies from the nasal lesions finally were described as consistent with scleroma, in that there was a granulomatous infiltration of the lamina propria characterized by Mikulicz cells plasma cells and occasional Russell bodies Bacterial stains showed very many small bacilli within the Mikulicz cells On June 20, 1947, the bacillus of rhinoscleroma was grown from nasal cultures A streptomycin sensitivity test revealed no growth in the presence of 0 1 mg per milliliter of streptomycin

Streptomycin therapy was started on July 1 1947 One gram was dissolved in 8 cc of normal saline and four doses of 2 cc each were given intramuscularly each day A half a gm in 4 cc of normal saline was given daily by nebulizer in four divided doses The treatment was continued for six weeks At the end of the first 48 hours there were no longer any crusts in the nose and much less crusting in the larynx but crusting extending into both main bronchi for 1 to 2 cm had to be removed by bronchoscopy on July 13 1947 On July 22 1947 there was very little crusting in the larynx and tracheobronchial tree and the aerosol streptomycin was discontinued On Aug 1, 1947, bronchoscopy revealed much less infiltration of the mucosal walls, but there was still some stenosed and some thin white crusts The tracheotomy tube was removed at the end of the first two weks of treatment Treatment was discontinued on Aug 12, and the patient was discharged on Aug 15 1947

The trachea has remained wide open and there has been slight thin dry white crusting of its anterior wall On Jan 6 1948, tracheoscopy and bronchoscopy revealed very little smooth surfaced slightly irregular thickening of the tracheal mucosa, but no crusting and no abnormal findings in the bronchi The nose remains full of crusts

DIAGNOSIS

From these cases and others that I have seen, it seems to me that scleroma usually involves the larynx subglotically The true cords may be slightly infiltrated and their movements restricted, but the obstructing lesion and crusting appear below them Dark purple-red granulomatous masses that bleed easily are usually seen when the crusts present are removed The lesions are painless, just as in the nose and pharynx The involvement usually seems to be of the diffuse infiltrative type and is usually seen by the endoscopist in either the hard granulomatous stage or the later stenotic fibrotic stage Any part of the trachea, carina and large bronchi may be involved While the flattened-nodular granulomatous infiltration is frequently seen in the immediate subglottic area, it is the fibrotic stenosing stage that is usually encountered lower down the trachea and in the bronchi This stenosis causes gradually increasing dyspnea and wheezing Morrison[3] has reported a patient with scleroma in whom there was great dilation of the main bronchial openings and the lower one-third of the trachea below the lower of two diaphragm-like fibrotic obstructions of the trachea In the fibrotic stages the mucosa is paler, smoother and harder In the trachea the lesions are usually concentric Crusting in these areas is not so great nor so wet as in the nose or other upper respiratory passages Any stenotic obstructing lesion should be suspected of being scleroma The diagnosis is difficult to make histologically from the trachea and bronchi because it usually seems to be encountered here in these later stages when the foam cells and bacilli are less numerous In all of the above three cases the clinical diagnosis of scleroma was proven by obtaining positive biopsies from nasal lesions Cultures made from secretion swabbed from the scleromatous nasal mucosa after crusts have been removed will usually grow readily and abundantly on all ordinary media Cultures made from a crushed piece of fresh biopsy tissue are rarely necessary

TREATMENT

In the past, treatment consisting of X-ray or radium irradiation, fulguration and chemotherapy[4] has usually given little relief, and the disease has progressed In these three cases and one reported by New,[5] streptomycin certainly caused sudden dramatic improvement Not only was there great clearing of the disease process, but most of the improvement gained seems to have persisted Interestingly, improvement of the nasal lesions present in the same patients was not so great nor so lasting Maybe larger doses or longer treatment will be the answer If the lesions do not disappear or greatly regress with the streptomycin therapy, the only other procedure of value is the repeated biting away of obstructing tissues

SUMMARY

Three cases of scleroma of the larynx, trachea and bronchi have been presented The usual laryngeal lesions appears to be only a slight reddened infiltration of the true cords, but great obstructing granulomatous infiltration of the subglottic area Scleroma lesions in the trachea and bronchi tend to be of the diffuse concentric infiltrative type of either the firm granulomatous stage or the later fibrotic stenotic stage The disease should be suspected whenever there is a stenosing obstruction of the trachea and bronchi If biopsies do not show all of the characteristics of this disease, the diagnosis can many times be proven by biopsies and cultures from the nose In treatment, streptomycin seems to offer more than anything else used so far

REFERENCES

1 Alderson, H E Scleroma in California *Calif and West Med*, 47 317, Nov, 1937

2 Cunning, D, and Guerry, D Scleroma *Arch Otolaryngol*, 36 662 Nov, 1942

3 Eggston, A, and Wolff, D Textbook Histology of the Ear, Nose and Throat Williams and Wilkins Co, 1947, pp 714 720

4 Falcao, P Rhinoscleroma in Brazil *Arch Otolaryngol*, 45 466, Apr, 1947

5 Figi, F, and Thompson, L Rhinoscleroma *Jour A M A* 91 637, Sept 1, 1928

6 Levine, M, and Hoyt, R Diagnosis of Scleroma *Arch Otolaryngol*, 47 438, Apr, 1948

7 Morrison, L F Scleroma (Rhinoscleroma) Report of Three Cases *Arch Otolaryngol*, 28 531, Oct, 1938

8 New, *G B*, *et al* Rhinoscleroma Apparently Cured with Streptomycin *Ann Otol*, *Rhinol and Laryngol*, 57 412, June, 1948

9 Reyes, E Rhinoscleroma *Arch Dermat and Syph*, 54 531, Nov 1946

10 Szmurlo, J Anatomicopathology of Scleroma *Trans Sec Internat Cong Otorhinolaryngol*, *Arch Otolaryngol*, 18 393, Sept, 1933

11 Watkins, S S Primary Scleroma of the Larynx in a Negro Born in Maryland *Surg*, *Gynec and Obst*, 33 37, July, 1921

500 South Lucas Avenue

THE FENESTRATION OPERATION — INDICATIONS, TECHNIQUE AND RESULTS *†‡

J. BROWN FARRIOR, M.D.,
Tampa, Fla.

With a series of 144 fenestration operations, I propose to offer no contribution to the field of fenestration surgery; I have, however, learned a great deal. I have learned something of the indications for the fenestration operation; this, I hope, will be of interest to every otolaryngologist. I have learned many practical points in the technique which may be of value to others, and I have learned something of the good and the bad results which are to be expected from fenestration surgery.

INDICATIONS

The fenestration operation is indicated only in moderate degrees of otosclerosis with adequate retained inner ear function. The most critical frequency for determining this inner ear function is at 1024 dv. The 1024 magnesium tuning fork is, to me, the most valuable single test in determining the suitability of clinical otosclerosis for the fenestration operation. If, in clinical otosclerosis, the bone conduction is normal or prolonged with the 1024 magnesium tuning fork, the patient probably is a candidate for the fenestration operation. If the bone conduction is appreciably shortened with this tuning fork, the patient probably is not a candidate for the fenestra-

---

*Read at the meeting of the Southern Section American Laryngological Rhinological and Otological Society, Inc., Washington, D. C., Jan. 10, 1949.

†From the Department of Otolaryngology, Tampa Municipal Hospital, Tampa, Fla.

‡Illustrated with color movie.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Feb. 1[illegible], 1949.

tion operation In a busy office practice, without time for detailed and complete hearing tests, this single test is good presumptive evidence of the patient's suitability for surgery

Detailed and complete hearing tests are necessary for accurate evaluation It is my practice to make an air conduction audiogram, a bone conduction audiogram (with masking of the opposite ear), to time the duration of the bone conduction and the air conduction with calibrated magnesium tuning forks of the frequencies of 512, 1024 and 2048 dv, and, in addition, to measure the patient's ability to understand the low conversational voice and whisper These tests are repeated at least twice before surgery

With the detailed audiogram, correlated with the findings of the tuning forks, otosclerosis may be classified as early, moderate, moderately severe and severe [1-3]

Early Otosclerosis

In early otosclerosis, the patient exhibits a flat or ascending audiogram, with hearing at or above the 30 db level for the speech frequencies of 512, 1024 and 2048 The Rinne test will be negative with the 256 tuning fork, with the 512, the Rinne may be negative, but, with the 1024 and 2048 tuning forks, the air conduction remains longer than bone conduction The bone conduction is prolonged over normal with the 512, the 1024 and the 2048 tuning forks The fenestration operation is not indicated in early otosclerosis, for the patient still has useful hearing, further, if the patient still has useful hearing in the better ear, the fenestration operation is not indicated in the more involved ear

Moderate Otosclerosis

In moderate otosclerosis (see Fig 1), the patient exhibits a flat or ascending type audiogram, with the hearing for the speech frequencies of 512, 1024 and 2048 below the critical level of 30 db The bone conduction is normal for the speech frequencies The Rinne is now negative with the 512 tuning fork, bone conduction and air conduction are about equal with

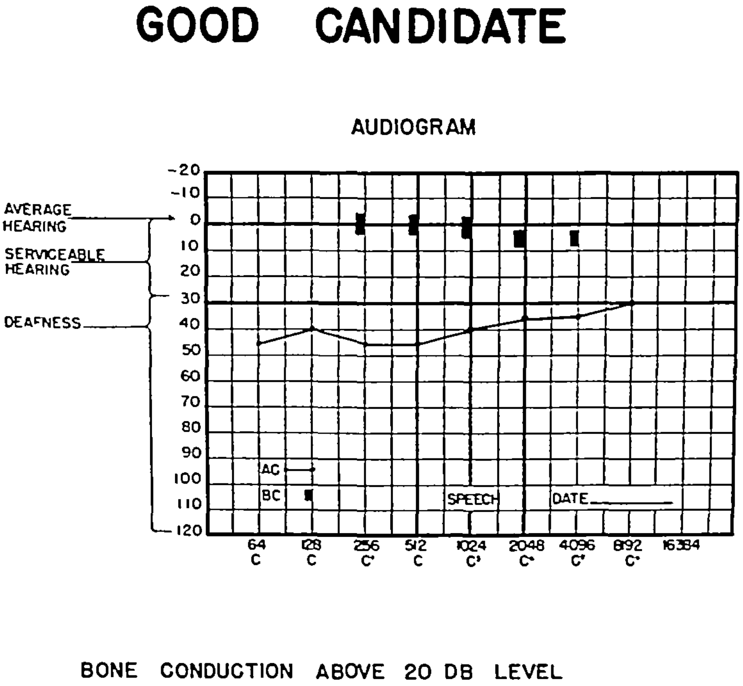


Fig 1 Moderate otosclerosis presents a flat or ascending air conduction audiogram with normal bone conduction This is a good candidate for the fenestration operation

the 1024 tuning fork, and the Rinne remains positive with the 2048 fork Such patients are ideal candidates for the fenestration operation

Moderately Severe Otosclerosis

In moderately severe otosclerosis (see Fig 2), the patient exhibits a sloping type of audiogram, with a more severe loss of auditory acuity for the higher tone frequencies, indicating loss of cochlear reserve The bone conduction audiogram is sloping The bone conduction is still normal at 512 There is slight loss of bone conduction at 1024, but, at this frequency, the bone conduction has not fallen below the 20 db level The bone conduction for the frequency 2048 is near the 30 db level With the 512 tuning fork, the Rinne is negative and the bone conduction is prolonged With the 1024 fork, bone conduction

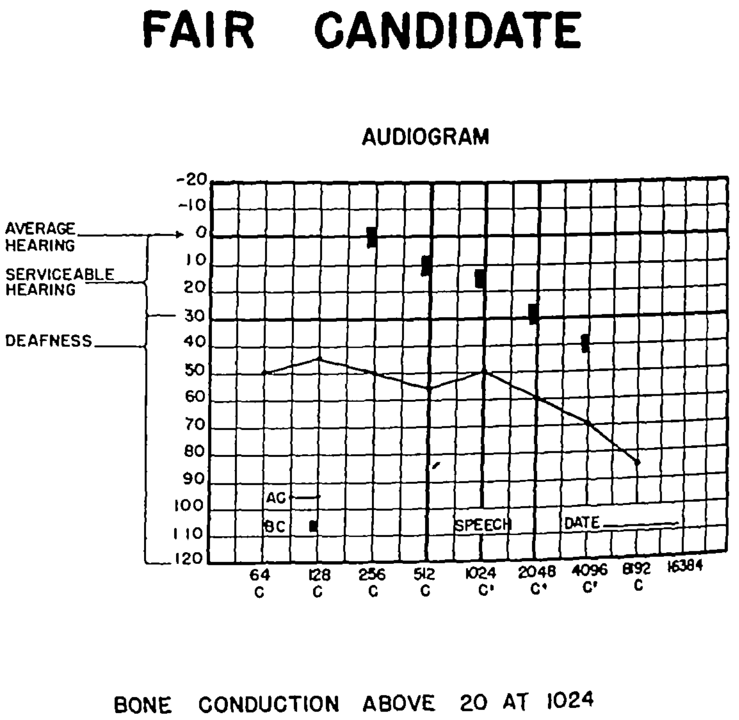


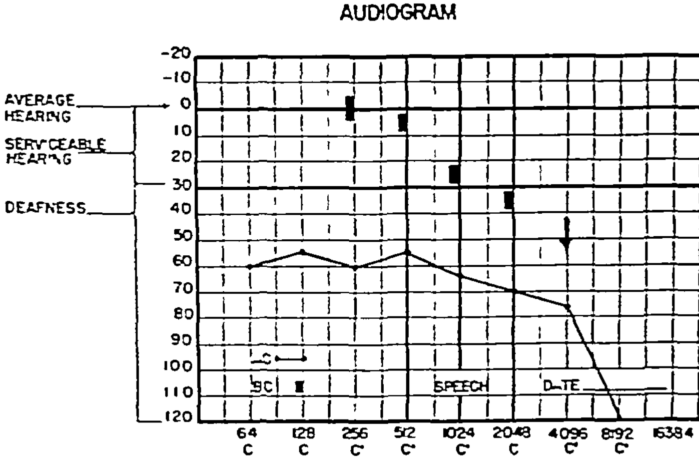
Fig 2 Moderately severe otosclerosis presents a sloping air conduction audiogram and a sloping bone conduction audiogram with bone conduction at or above the 20 db level at the critical frequency of 1024 dv This is a fair candidate for the fenestration operation

and air conduction are equal, with bone conduction, normal or prolonged Air conduction is still greater than bone conduction with the 2048 fork, and bone conduction is shortened with this fork Depending upon the degree of nerve involvement, these patients are good to fair candidates for the fenestration operation

Severe Otosclerosis

In severe otosclerosis (see Fig 3), the patient exhibits a sharply sloping air conduction audiogram, with a severe loss for the higher tone frequencies, indicating severe loss of cochlear reserve With the bone conduction audiogram, the bone conduction is still normal or nearly normal at 512 At 1024, the bone conduction has fallen below the critical level of 20

POOR CANDIDATE



BONE CONDUCTION BELOW 20 AT 1024

Fig 3 Severe otosclerosis presents a sharply sloping air conduction audiogram with bone conduction below the critical level of 20 db at 1024 d v This is a poor candidate for the fenestration operation and I will advise a hearing aid.

db , and the bone conduction is below the 30 db level at 2048 With the 512 magnesium fork, the Rinne is negative and the bone conduction is still prolonged over normal The bone conduction is shortened with the 1024 fork, and the Rinne may now be negative with the 1024 fork The bone conduction and air conduction are appreciably shortened at 2048, but I have never seen a negative Rinne at this frequency In severe otosclerosis, the patient is a poor candidate for the fenestration operation, and I will advise a hearing aid

Tuning Fork Testing

In performing the tuning fork test the magnesium fork is preferred to the usual steel fork because of its longer duration of vibration This prolonged duration of vibration decreases the margin of error in testing As previously described, the forks of the speech frequencies of 512, 1024 and 2048 dv per second are utilized in the preoperative testing of otosclerosis Each examiner should time in seconds the normal duration of air conduction and the normal duration of bone conduction for his individual set of forks, for these factors will vary with the individual fork and with the noise level of the individual examining room I know these time factors for my forks in my hearing room and place the greatest reliance upon these tuning fork tests

To summarize the indications, the fenestration operation is indicated in bilateral moderate and moderately severe otosclerosis with adequate retained inner ear function, particularly as determined for the frequency of 1024 dv per second.

SURGICAL TECHNIQUE

Varying from the classical Lempert technique, the following procedures have proven to be of practical value

1. General anesthesia is preferred
2. A modified Shambaugh type of incision is used
3. The flap is elevated before any bone surgery.
4. The antrum is approached directly through the canal wall
5. The incus is removed as soon as it is accessible
6. The flap is continuously protected with surgical rayon
7. The primary skin graft is advocated to prevent postoperative otorrhea

GENERAL ANESTHESIA

General anesthesia is preferred to local anesthesia, having advantages for the patient and for the surgeon From the standpoint of the welfare of the patient, general anesthesia provides more scientific control of the depth of anesthesia, the occasional discomforts of local anesthesia are eliminated and the postoperative hangover is greatly reduced From the standpoint of the surgeon, with general anesthesia, the operator may devote his uninterrupted attention to the minute perfection of surgical technique without the interrupting annoyances of local anesthesia With general anesthesia, as compared to local anesthesia, bleeding during the operation is the same, or less, and the hearing improvement is the same The type of general anesthesia used is intratracheal nitrous oxide and oxygen, combined with intravenous pentobarbital sodium narcosis When administered by a well trained and competent medical anesthetist there is no concern about the patient's general welfare

For my first 100 fenestrations, the anesthetic routine was the Banower heavy barbiturate sedation and morphine, supplemented with local infiltration with 1 per cent novocaine and the topical application of 10 per cent cocaine in the middle ear (utilized in 86 of the 100 cases) At the completion of the series, I felt that this was the method of choice On moving to Tampa, Dr Carron prevailed upon me to try general anesthesia This has been used in 41 consecutive cases A comparison of the operative statistics on these two series, considering the quality of the anesthetic, the bleeding during the operation, the postoperative course and the end-result, has convinced me to continue utilizing this method

The quality of the local anesthesia in the 86 cases was classed as good in 62, fair in 10, poor in three, and no good in 11, requiring delayed supplemental intravenous pentothal In the 41 cases with general anesthesia, the anesthetic has been uniformly good

The bleeding during the operation with local anesthesia alone was classed as minimal in 46, annoying in 26, severe in three The bleeding during the operation with local with delayed supplemental pentothal was classed as minimal in four, annoying in four, and severe in three The bleeding in general anesthesia has been classed as minimal in 32, annoying in nine, and severe in none Summarizing this comparison, bleeding was significant in 41 9 per cent of 86 cases with local (or local with delayed supplemental pentothal), while bleeding was significant in 21 9 per cent of 41 cases with general anesthesia This comparison should be qualified by one change in surgical technique, in the 41 cases under general anesthesia, the flap has been turned prior to any bone surgery to allow time for the canal bleeding to stop before opening the labyrinth

The postoperative course has been more placid in patients with general anesthesia The patient responds before leaving the operating room The patient will occasionally sit up on the afternoon of the operation The patient is usually out of bed, with assistance, on the first or second postoperative day The nausea, vomiting and vertigo are reduced

The elimination of the use of topical cocaine in the middle ear may be a factor in reducing the nausea, vomiting and vertigo In 1946, I presented my experience with tympanosympathetic block (relative to tympanosympathectomy for tinnitus), whereby 0 5 cc of 10 per cent cocaine was instilled into the middle ear to determine the effect upon tinnitus When this was done, the cocaine was absorbed into the inner ear The patients (three in number) became violently dizzy, very severe nausea, vomiting and vertigo lasted six to 10 hours, and the patients were miserable on the next day Yet, instilling 10 per cent cocaine into the attic and middle ear is routine with local anesthesia for fenestration If cocaine is to be used in fenestrations, it should not be instilled, but should be applied on applicators

The postoperative hearing restoration has been the same in general and local anesthesia It is interesting to note that of my five early closures of the fenestra, three occurred when the local anesthesia was a problem Admitting human failings, it may have been that the diversion of my attention from the surgical perfection of the technique to the anesthetic problem was responsible for some technical imperfection Under gen eral anesthesia, the operation is not interrupted by the vomiting, straining or crying patient, and the surgeon's attention is devoted entirely to the minutely accurate surgical technique

INCISION

To avoid stenosis of the auditory canal and to aid in the epithelialization of the cavity, I have utilized a modified type of Shambaugh[4] incision, preserving all of the skin of the canal and removing the subcutaneous tissue and periosteum

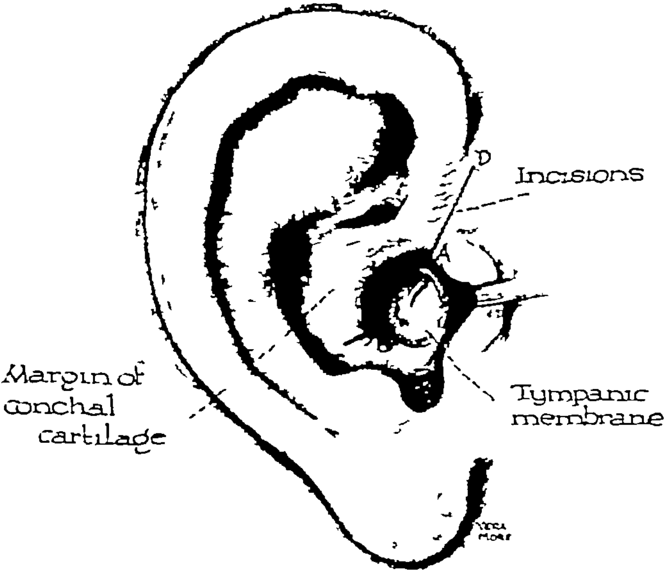


Fig 4 The endaural incision A B C-A D preserves all the skin of the canal The subcutaneous tissue is excised and discarded and the resultant flap protects the margin of the conchal cartilage and prevents stenosis of the auditory canal

The incision is begun at point A (see Fig 4) at 12 o'clock, at the junction of the inner two-thirds with the outer one-third of the auditory canal At the same depth in the canal, the incision is carried from 12 o'clock around the posterior rim of the canal to 7 o'clock in the right ear (5 o'clock in the left ear) The incision is then downward and outward to the rim of the cymba conchae The second, or vertical, incision begins at the original point A, at 12 o'clock, and is carried vertically upward, through the subcutaneous tissue and periosteum to the rim of the temporal muscle, then, superficial to the temporal muscle, between the helix and the tragus, as in the Lempert[6] incision The skin and periosteum are then elevated from the cortex of the outer portion of the bony wall of the auditory canal and from the adjacent mastoid The pedicle thus created is grasped at its inner extremity with the Allis forceps and the epithelium elevated from the subcutaneous tissue The subcutaneous tissue is excised along the margin of the conchal cartilage and the inferior border of the temporal muscle This tissue is discarded The epithelium of the flap covers the rim of the conchal cartilage and prevents stenosis of the auditory canal This incision is little more than the endaural modification of the classic Koerner flap

At the termination of the operation, the upper two-thirds of the vertical incision is closed with a single vertical mattress suture and the flap is tucked around the border of the conchal cartilage, where it is held in position by the pressure of the rayon synthetic sponge packing (see Fig 9)

PRIMARY ELEVATION OF THE TYMPANOMEATAL FLAP

The tympanomeatal flap is elevated, thinned and cut before any bone surgery (see Fig 5) This primary elevation of the flap permits time for absolute hemostasis of the canal vessels before the labyrinth is opened In addition, the primary elevation of the flap affords immediate orientation of the slope of the canal wall and the position of the notch of Rivinus

Before the self-retaining retractor is inserted, the skin of the anterior canal wall is incised 3 mm external to the bony canal and extending upward into the vertical incision This incision provides better exposure over the zygoma without tension on the tympanomeatal flap The tympanomeatal flap is then elevated Incisions are made from the annulus tympanicus, outward, at the posteroinferior and the anteroinferior angles of the canal As pointed out by Shambaugh,[illegible] the cutaneous lining of the anterior wall of the canal provides the

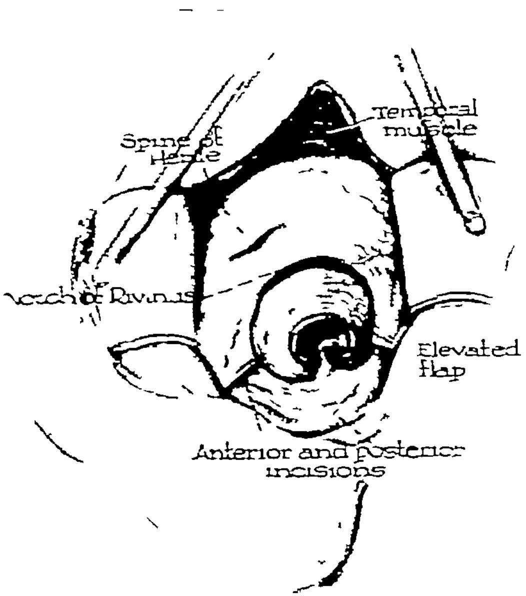


Fig 5 The primary elevation of the flap permits time for absolute hemostasis of the canal vessels before the labyrinth is opened and permits the direct approach to the mastoid antrum.

thinnest possible covering for the fenestra The excess of subcutaneous tissue is removed from the peripheral portion of the flap The entire exposed surface of the flap is covered with a layer of surgical rayon* This protective covering of rayon protects the flap from any bone dust or bone spicules, and from the surgeon

THE DIRECT ATTICOANTROTOMY

The primary elevation of the tympanocutaneous flap permits the direct approach to the mastoid antrum through the thin bony wall of the auditory canal (see Fig 6) When the mastoid and the zygoma are pneumatic, the cortex of the outer two-thirds of the superior and the posterior bony walls of the auditory canal and the adjacent mastoid cortex over the antrum are removed simultaneously This direct approach to

---

*Owens Surgical Fabrics Hamilton Mills Division Winchester Mills New York, N Y

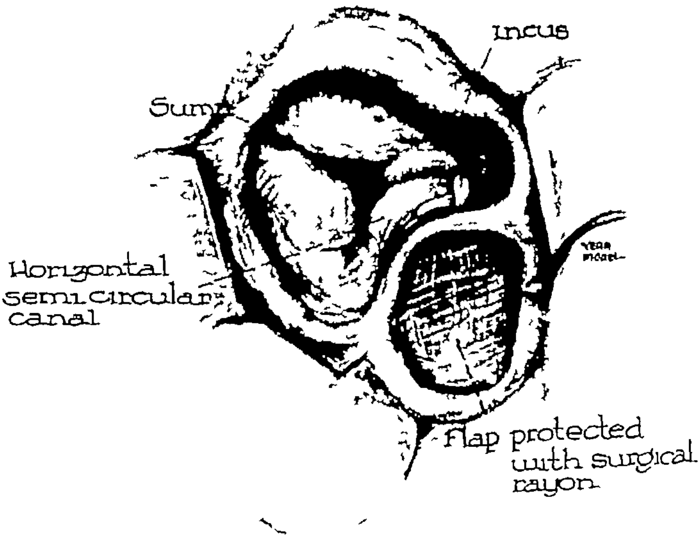

incus
Sump
Horizontal semicircular canal
Flap protected with surgical rayon

Fig 6 The direct atticoantrotomy is accomplished by the simultaneous removal of the cortex of the outer two-thirds of the bony canal wall and the adjacent mastoid cortex

the antrum and attic discards the Schwartze technique of preserving the bony canal and approaching the attic from behind In this technique, the flap is protected by the surgical rayon rather than the bony wall of the canal The sole purpose of the atticoantrotomy is to create adequate exposure of the site of the fenestra and to provide a cavity which is easily cleaned Formerly, all mastoid air cells were exenterated, this created an unnecessarily large cavity and frequently delayed healing To facilitate healing, the present trend is to create only an atticotomy, as advocated by DeLima[7] and adapted by Shambaugh,[6] this small cavity has advantages, but the surgeon should always create enough room to avoid cramping his individual surgical technique

EARLY REMOVAL OF THE INCUS

Having opened the antrum and removed the external wall of the attic, the incudomalleolar articulation its exposed The incus is removed as soon as the exposure will permit (see Fig 7) The early removal of the incus permits the maximal

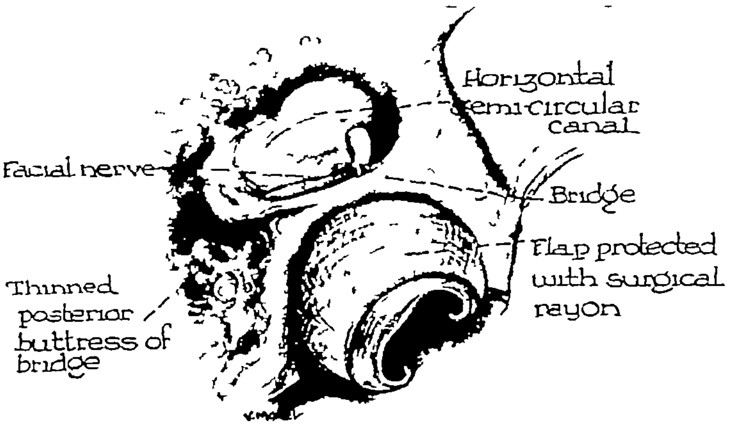

Horizontal semi-circular canal
Facial nerve
Bridge
Flap protected with surgical rayon
Thinned posterior buttress of bridge

Fig 7 The early removal of the incus permits maximal thinning of the bridge and the posterior buttress of the bridge with the surgical burr

thinning of the bridge and the posterior buttress of the bridge with the surgical burr In thinning the bridge, to prevent "running" of the burr toward the flap, the burr should always rotate in a superior direction (counterclockwise in the right ear and clockwise in the left ear) With the burr coursing over the horizontal canal, the posterior buttress of the bridge may be thinned from above down to the level of the corda tympani nerve and on a plane with the vertical course of the facial nerve With the Lempert rongeur, a bridge so thinned may be removed posteriorly to the plane of the vertical course of the facial nerve

THE FENESTRA

The contour and the accurate debridement of the fenestra are the *sine qua non* of fenestration surgery As pointed out by Lempert,[9-11] the fenestra should be placed on the elevated ampulla of the horizontal canal (see Fig 8) The endosteal margins should be sharp, the endosteum should not be traumatized and all endosteum and osteogenic endosteal bone dust should be removed Toward this goal, I continue to use the burr only under irrigation to remove the osteogenic bone dust, to create a wide elevated blue ovoid at the site of the fenestra,

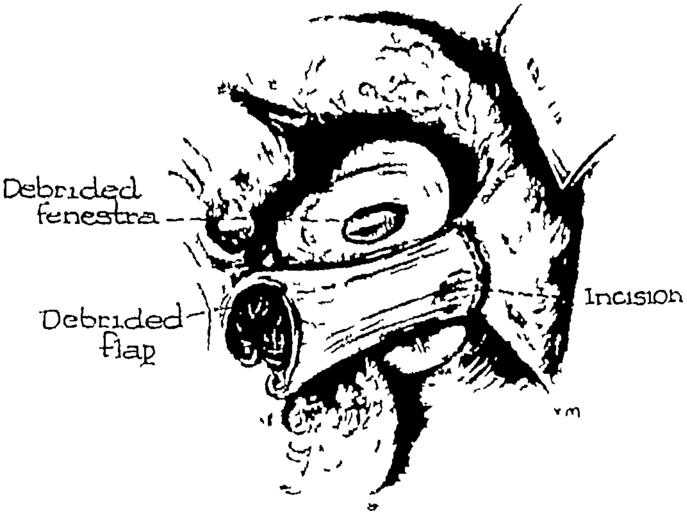


Fig 8 Stretching the flap posteriorly parallel to the fenestra the adjacent under surface of the flap is accurately debrided (all osteogenic bone spicules removed)

to pulverize the endosteal bone with the polishing burr, to polish the margins of the fenestra with the gold burnishing burr and to debride the margins of the fenestra with the Shambaugh picks

THE TYMPANOCUTANEOUS FLAP

I want to make five points relative to the flap First, as has been previously stated, the flap is continuously protected with a layer of surgical rayon whenever any bone surgery is in progress This surgical rayon prevents bone dust and bone spicules from accumulating on the undersurface of the flap and makes debridement of the flap a more certain and less arduous task Further, the surgical rayon prevents a film of coagulated blood from accumulating on the undersurface of the flap

Second, in the elevation and the subsequent manipulation of the flap, it is always treated with the greatest delicacy, agreeing with Day[8] that the less the flap is traumatized, the less will be the postoperative edema of the flap and postoperative labyrinthine reaction To minimize the trauma, the flap is never touched with the suction but only with the moistened cotton applicator to which the suction is applied

Third, as all authors have stressed, the undersurface of the flap is searched for any attached osteogenic bone spicules or bone dust which would rapidly occlude the fenestra In the debridement of the flap, all such osteogenic particles are removed

Fourth, after the fenestra has been completed, the folded flap is stretched posteriorly, parallel to the fenestra (see Fig 8), and that portion of the flap which is to cover the fenestra is again searched and any osteogenic spicules removed

Fifth, the anterior attachment of the flap is not cut free from the anterior portion of the annulus tympanicus until the fenestra is complete, to avoid shredding of this delicate skin of the anterior wall of the canal The cavity is then thoroughly irrigated and the flap floated into position over the fenestra The flap is covered with a protective layer of surgical rayon The flap and the rayon are held in position over the fenestra with two small pledgets of synthetic sponge The sponge should be gently pressed over the fenestra, for, if the packing is placed tightly over the fenestra, there will be ischemia of the flap and, when the packing is removed, there will result secondary hyperemia and labyrinthine reaction

THE PRIMARY SKIN GRAFT

The denuded area in a fenestration cavity may vary from 6 to 18 sq cm Illustrated mathematically, a cavity 1 cm in diameter and 2 cm deep has a side wall surface of 6 2832 sq cm , a cavity 2 cm in diameter and 2 cm deep has a side wall surface of 12 5664 sq cm , while a cavity 3 cm in diameter and 2 cm deep has a side wall surface of 18 8496 sq cm Such denuded areas are exposed to infection for the weeks or months required for spontaneous epithelialization I have,

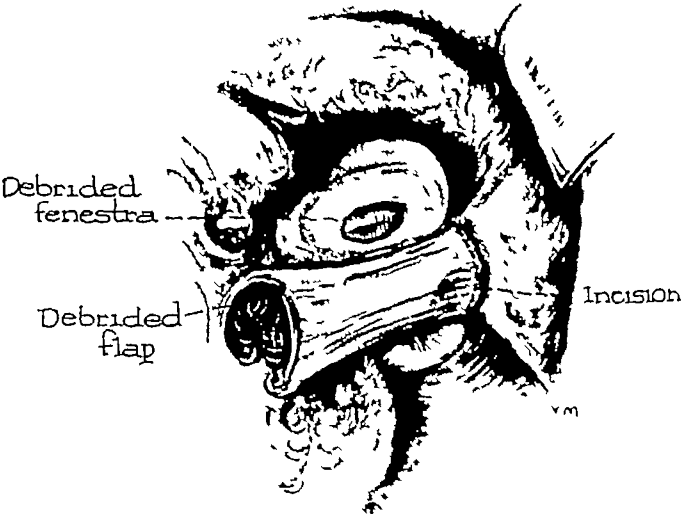


Fig 8 Stretching the flap posteriorly parallel to the fenestra the adjacent under surface of the flap is accurately debrided (all osteogenic bone spicules removed)

to pulverize the endosteal bone with the polishing burr, to polish the margins of the fenestra with the gold burnishing burr and to debride the margins of the fenestra with the Shambaugh picks

THE TYMPANOCUTANEOUS FLAP

I want to make five points relative to the flap First, as has been previously stated, the flap is continuously protected with a layer of surgical rayon whenever any bone surgery is in progress This surgical rayon prevents bone dust and bone spicules from accumulating on the undersurface of the flap and makes debridement of the flap a more certain and less arduous task Further, the surgical rayon prevents a film of coagulated blood from accumulating on the undersurface of the flap

Second, in the elevation and the subsequent manipulation of the flap, it is always treated with the greatest delicacy, agreeing with Day[8] that the less the flap is traumatized, the less will be the postoperative edema of the flap and postoperative labyrinthine reaction To minimize the trauma, the flap is never touched with the suction but only with the moistened cotton applicator to which the suction is applied

Third, as all authors have stressed, the undersurface of the flap is searched for any attached osteogenic bone spicules or bone dust which would rapidly occlude the fenestra In the debridement of the flap, all such osteogenic particles are removed

Fourth, after the fenestra has been completed, the folded flap is stretched posteriorly, parallel to the fenestra (see Fig 8), and that portion of the flap which is to cover the fenestra is again searched and any osteogenic spicules removed

Fifth, the anterior attachment of the flap is not cut free from the anterior portion of the annulus tympanicus until the fenestra is complete, to avoid shredding of this delicate skin of the anterior wall of the canal The cavity is then thoroughly irrigated and the flap floated into position over the fenestra The flap is covered with a protective layer of surgical rayon The flap and the rayon are held in position over the fenestra with two small pledgets of synthetic sponge The sponge should be gently pressed over the fenestra, for, if the packing is placed tightly over the fenestra, there will be ischemia of the flap and, when the packing is removed, there will result secondary hyperemia and labyrinthine reaction

THE PRIMARY SKIN GRAFT

The denuded area in a fenestration cavity may vary from 6 to 18 sq cm Illustrated mathematically, a cavity 1 cm in diameter and 2 cm deep has a side wall surface of 6 2832 sq cm , a cavity 2 cm in diameter and 2 cm deep has a side wall surface of 12 5664 sq cm , while a cavity 3 cm in diameter and 2 cm deep has a side wall surface of 18 8496 sq cm Such denuded areas are exposed to infection for the weeks or months required for spontaneous epithelialization I have, therefore, adopted the routine application of a primary skin graft to facilitate healing of the fenestration cavity and to prevent the annoying postoperative otorrhea

As described in detail for the radical mastoidectomy,[1] the ear and the donor site are aseptically prepared and the graft taken before the ear surgery is begun At the completion of the fenestration operation, with the flap held in position with rayon and synthetic sponge, the remainder of the cavity is lined with the split thickness skin graft To make the skin more manageable, it is backed with surgical rayon and cut in pattern to line the cavity The skin and surgical rayon (see Fig 9) are held in position with synthetic sponge packing for seven days

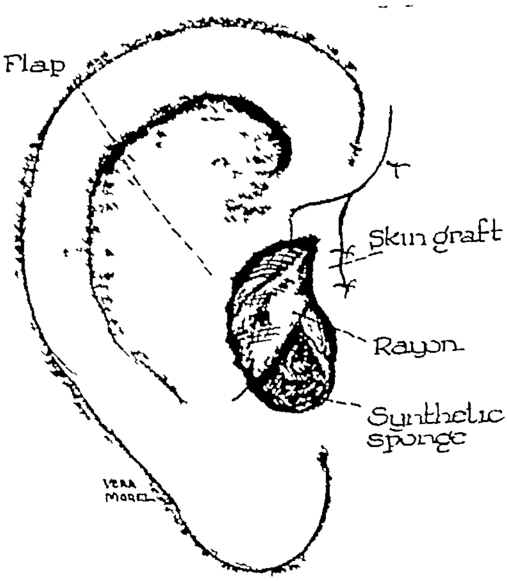


Fig 9 The denuded fenestration cavity is lined with a primary split thickness skin graft which is held in position by rayon and synthetic sponge packing

COMPLICATIONS

In this series, there have been no serious complications and no deaths One patient (an incidence of 0 7 per cent) developed a transient facial paralysis which lasted from the eighth to the twenty-first postoperative day, this was temporarily humiliating but of no permanent consequence One patient developed a perichondritis, which subsided on penicillin therapy

Slight, insignificant dizziness on sudden motion, blowing of the nose, movement of the ear or using cold ear drops is not an infrequent symptom following the fenestration operation, however, patients do not express this symptom as a complaint Significant vertigo has persisted in three, or 2 1 per cent of patients In one of these, there is a recurrent area of granulation on the anterior border of the flap The other two patients who complain of vertigo occurred in a series of seven patients in whom the head of the malleus was left in position

The greatest single nuisance factor in fenestration surgery is the annoying postoperative otorrhea This may last for months or years In general, in my office and throughout the country, these postoperative fenestration cavities are overtreated Time is more important than local treatment in the epithelialization of these denuded areas

Scant otorrhea requires no local office treatment The patient may cleanse the canal and report to the office once or twice a month for inspection of the cavity Unnecessary swabbing of these cavities may destroy the epithelial margins

When there is moderate otorrhea and no excess granulation tissue, the cavity should be kept from debris with a cleansing ear drop I utilize glycerite of hydrogen peroxide with barbamide or one of the ear drops containing urea, glycerine and sulfa suspension Again, the patient reports to the office once or twice a month for inspection of the cavity When the excess discharge subsides, the ear drops are discontinued

When inspection of the cavity reveals exuberant granulation tissue and there is no drug sensitivity, more active local treatment is necessary If the infection is in the acute phase, it may respond to penicillin in saline ear drops or packing the cavity with fine mesh gauze soaked in penicillin and saline Chronic granulation tissue should be removed with the Coakley curette and the base of the granulations cauterized I preventing the recurrence of these granulations, I have run the gamut of all forms of local therapy and have reverted to the practice of the early otologists and pack these cavities tightly with heavily lubricated vaseline gauze packing Replacing this packing one, two or three times weekly for two or three weeks will frequently result in complete healing of an otherwise refractory cavity

This otorrhea is most annoying to the patient in the first postoperative months In the 100 cases who are now more than one year postoperative, nine record slight discharge and three complain of marked discharge

IMMEDIATE RESULTS

Analysis of 100 consecutive fenestration operations (Cases 19 through 118, inclusive) reveals that the operation was at

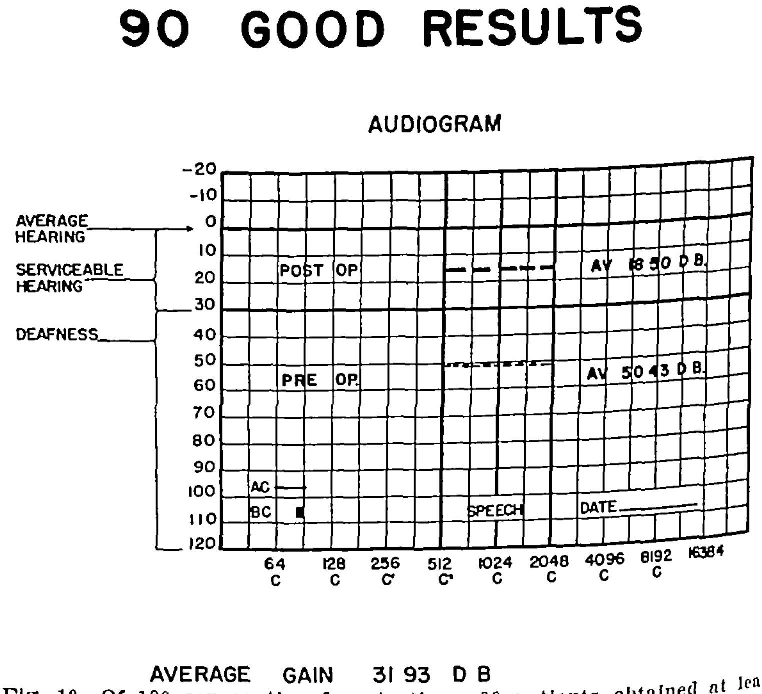


Fig 10 Of 100 consecutive fenestrations 90 patients obtained at least temporary good hearing

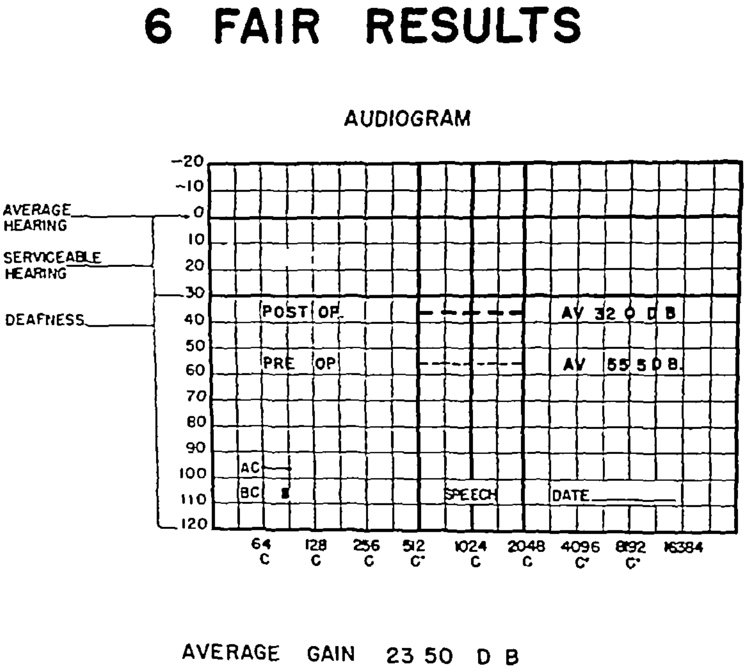


Fig 11 Of 100 consecutive fenestrations six additional patients obtained at least temporary useful hearing improvement.

least temporarily successful in 96 patients and a failure in four patients Of the 96 rehabilitated patients, there were 90 good results and six fair results The 90 good results (see Fig 10) had the hearing restored to the serviceable level, an average postoperative level of 18 5 db on their best audiogram These patients had an average gain of 31 93 db from an average preoperative hearing level of 50 43 db for the speech frequencies This improved their ability to understand low conversational voice from an average preoperative distance of 4 3 inches to an average postoperative distance of 196 3 inches The six fair results (see Fig 11) had hearing improved to the 32 db level on their best audiogram These patients had an average gain of 23 5 db from an average preoperative level of 55 5 db This improved their ability to understand low conversational voice from an average preoperative distance of 2 6 inches to an average postoperative distance of 68 inches These patients are able to conduct their affairs without the use of a hearing aid The four poor results (see Fig 12) had an average postoperative hearing loss of 7 7 db, from 57 5 db level to 65 2 db level Three of these four failures occurred in patients with questionable inner ear function

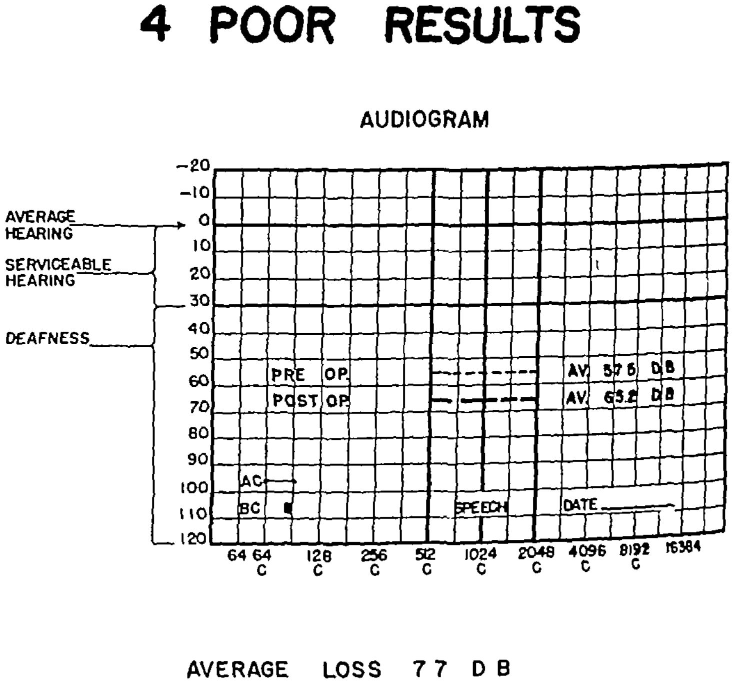


Fig 12 Of 100 consecutive fenestrations there were four poor results

LASTING RESULTS

Hearing maintained at a constant level for a period of one year is regarded as a statistically reportable lasting result In this series there are 91 patients (of the first 100 fenestrations) who regained serviceable hearing and who are now 12 to 33 months postoperative Of these 91 patients, 82, or 90 1 per cent, have retained useful hearing As previously reported, 85 of these patients received initial good results, with an average maximum gain of 30 9 db for the speech frequencies, attaining the average postoperative hearing level of 19 4 db, six of these patients received initial fair results, with an average maximum gain of 16 8 db , to attain an average postoperative hearing level of 33 8 db There are seven closures of the fenestra and two patients who have appreciated some loss in auditory acuity and are charted as closures As current audiograms are not available, this report is not accurate for research purposes, however, in reply to a current questionnaire, the patients state that they have useful hearing which has been a gratifying improvement over the preoperative level of deafness

Dividing the first 100 cases into groups of 20, on the basis of the questionnaire, it is interesting to note the consistencies of the shortcomings of the operation and my individual technique In Group I, now 26 to 33 months postoperative, 75 per cent now have useful improvement In Group II, 20 to 26 months postoperative, 90 per cent now have useful improvement In Group III, now 18 to 20 months postoperative, 80 per cent now have useful improvement In Group IV, now 16 to 18 months postoperative, 80 per cent now have useful improvement In Group V, now 12 to 16 months postoperative, 85 per cent now have useful improvement

It is interesting to note that 77 patients complained of head noises before surgery, in reply to the questionnaire, 12 to 33 months postoperative, these head noises have now disappeared in 19, are less in 38, are unchanged in 16 and are worse in four , or improved over preoperative in 74 per cent

AUDITORY TRAINING

The rehabilitation of the patient is the primary purpose of the fenestration operation The fenestration operation can restore serviceable hearing but not perfect hearing Audiometrically, equal hearing may be serviceable in one patient and unserviceable in another , the difference is in auditory training Auditory training teaches the patient to obtain the maximum utilization of the regained hearing

Training in speech reading will improve the value of the restored hearing With a few words of guidance, practical aural rehabilitation may be accomplished in the home The patient is instructed to have someone read to him for 30 minutes every day and to watch the reader's facial expressions My patients are instructed never to read their favorite section of the daily newspaper but to have it read to them The editorials and the columnists which develop a thought are ideal reading for auditory training, while the staccato style of Walter Winchell is worthless After a few readings in a silent room, the lessons are continued with the radio turned on to provide background noise In this way, the patient learns to interpret speech in the presence of noise and confusion Although the majority of fenestrated patients can get along without speech reading, this routine auditory training will help the minority to utilize their borderline hearing

When the fenestration operation is not indicated or when the fenestration operation is a failure, the patient must rely upon the hearing aid To utilize a hearing aid satisfactorily, the patient must become accustomed to amplified sound in the presence of background noise Such patients are required to use the aid in listening to their favorite radio programs, daily, and are encouraged to attend the movies When the ear has become accustomed to interpreting amplified sound, background noise is introduced In the home, the kitchen radio is brought into the living room and turned on some other program In the presence of this background noise, the patient continues to listen to the favorite radio program over the living room radio In this way, the patient adjusts to the interpretation of amplified sound in the presence of background noise He then proceeds to speech reading lessons in the presence of background noise When the adjustment is complete, the patient may wear the aid on the street and in noisy rooms without becoming confused

Auditory training in the home provides maximum rehabilitation of the patient whether the surgical result has been good, fair or poor This auditory training has not, however, ltered the statistical results presented in the preceding pararaphs Combining that which the patient can hear with that which he can see gives the patient every possible benefit from he hearing restoration

COMMENT

In properly selected patients, a properly performed fenesration operation is relatively free from any serious risk, the operation is usually successful and the hearing is usually maintained The greatest single nuisance factor in fenestration surgery is the persistent otorrhea, the primary skin graft reduces this nuisance

Regardless of decibels and statistics, the end-result to the patient will secure the future of fenestration surgery Realizing the psychological factors and the shortcomings of subjective methods of interpretation of results, the personal comments of these patients with semimature fenestra is overwhelming documentary evidence in favor of fenestration surgery With the exception of one psychotic patient and one intermittently vertiginous patient, all others classified as fair or good results express profound gratitude for the benefits of fenestration surgery The failures, the minority group, have, after a period of depression, adjusted to their handicap and utilized other auditory aids

At the present time, of the first 100 fenestrations which are not semimature, at 12 to 33 months postoperative, the best I can hope for is 82 per cent with maintained useful hearing, satisfactory to the patient A few others may be expected to lose their hearing during the second year This means that, of the first 100 cases, I have had nine immediate failures and nine that have closed or apparently will close The percentage of immediate failures is largely dependent upon the preoperative quality of the patient's inner ear function The percentage of closures is dependent upon the quality of the surgeon's technique, as the greatest number of variables are controlled by the surgeon It is only human to blame failures on the shortcomings of the operation itself We are at present in the heyday of fault-finding with statistical reports of results of the fenestration operation, the theme of this period is to blame all failures on the shortcomings of the operation This is erroneous If one patient will and one patient will not maintain hearing, the responsibility for the closure must rest squarely upon the surgeon My nine closures or apparent closures can only be the result of some imperfection of my technique, in the individual case In some one of the many potential sources of error, I have slipped up and either overdone or left undone Possibly, with more careful debridement of the flap, more meticulous fenestration technique and possibly with the coupoula and lead burr, I can minimize these human shortcomings

SUMMARY

1 The indications for the fenestration operation are outlined, otosclerosis being classified into early otosclerosis, moderate otosclerosis, moderately severe otosclerosis and severe otosclerosis

2 The fenestration operation is indicated in moderate or moderately severe otosclerosis

3 A modified Shambaugh incision is presented to preserve all possible epithelium, to aid in epithelialization of the cavity and to prevent stenosis of the auditory canal

4 Primary elevation of the flap is advocated to permit direct access to the mastoid antrum and to permit complete hemostasis of the canal vessels

5 Direct approach to the mastoid antrum through the auditory canal is advocated

6 Early removal of the incus is advocated to permit thinning of the bridge with the surgical burr

7 Protection of the flap with surgical rayon and thorough debridement of the flap is advocated

8 Rayon and synthetic sponge packing is advocated to maintain continuous pressure over the fenestra

9 Persistent otorrhea is the greatest single nuisance factor in fenestration surgery The primary skin graft of the fenestration cavity is advocated to facilitate primary healing

10 The technique of home aural rehabilitation is described to aid the fenestrated patient

ACKNOWLEDGMENTS

I acknowledge my indebtedness to my teachers Julius Lempert James H. Maxwell Philip Metzer George M Shambaugh Robert Moorhead and others Their teachings are incorporated in this paper

BIBLIOGRAPHY

1 Farrior, J Brown Discussion — The Fenestration Operation. *South Med Jour* 41 209, Mar, 1948

2 Farrior, J Brown The Fenestration Operation for Otosclerosis, Analysis of 100 Cases *Jour Fla Med Assn*, 35 17, July 1948

3 Farrior, J Brown The Fenestration Operation for Deafness *Jour Med Assn Ala* 16 317-322 Apr, 1947

4 Whitaker, C F Jr Jeurs, A. L and Shambaugh, G E Jr Mastoid Surgery, Modified Endaural Incision with Nerve Block Anesthesia

5 Lempert Julius Endaural Antauricular Surgical Approach to the Temporal Bone *Arch Otol*, 27 555-587 May, 1938

6 Shambaugh George E Jr., and Jeurs, Arthur L Surgical Treatment of Otosclerosis Preliminary Report of Improved Fenestration Technique *Arch Otolaryngol*, 43 549 567 June 1946

7 de Lima, T A otosclerose via Suprameatica. Rio de Janeiro 1943 Private publication

8 Day, K. M Appraisal of Fenestration Operation, Report of 100 Cases *Arch Otolaryngol* 44 547 559 Nov 1946

9 Lempert Julius Fenestra Novovalis, New Oval Window for Improvement of Hearing in Cases of Otosclerosis *Arch Otolaryngol*, 34 880 912 Nov, 1941.

10 Lempert Julius Lempert Fenestra Novovalis with Mobile Stopple *Arch Otolaryngol.*, 41 1-41 Jan 1941

11 Lempert Julius Bone Dust Free Lempert Fenestra Novovalis New Revolutionary Development of Surgical Treatment of Clinical Otosclerosis *Arch Otolaryngol* 47 280 288 Mar 1948

12 Farrior, J Brown The Radical Mastoidectomy Anatomical Considerations in Surgical Technique *Surg, Gynec and Obst.*, to be published

BACTERIAL ALLERGY AND THE IMPORTANCE OF OTOLARYNGOLOGICAL PROCEDURES *

O C HANSEN-PRUSS, M D (by invitation),†
Durham, N C

Introduction The existence of hypersensitiveness to bacteria, fungi and viruses is now a more or less accepted fact Every infection in man, unless it is a fulminating hematogenous affair, or occurs as a terminal event in a cachectic person, leads first to a state of hypersensitiveness to the bacteria which is then replaced, in certain instances, by temporary or permanent immunity It is beyond the scope of this paper to discuss the still controversial interdependence of allergy and immunity

The mechanism by which bacterial allergy develops is still a subject of argument Some investigators[1] believe that bacterial hypersensitiveness depends upon a specific antibody and that the antibodies are so closely bound to the cells that they cannot accumulate in sufficient excess in the circulation to permit passive transfer tests Other students state that a specific allergic mechanism is the basis of the delayed inflammatory reactions, and that these reactions are characteristic of infectious allergies[2] The presence of infectious tissue is then conceived to be an essential prerequisite for the production of bacterial allergy This is a viewpoint which is most attractive to me, and which dovetails with many of the observations made in this report Recent investigations have shown, furthermore, that bacterial hypersensitiveness can develop in individuals who will not manifest any clinical evidences of bacterial allergy and remain apparently healthy[3]

---

*Read at the meeting of the Southern Section American Laryngological Rhinological and Otological Society Washington D C Jan 10 1949

†From the Department of Medicine Duke University Durham N C

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 9 1949

It is apparent, then, that bacterial allergy can develop from overt infections, from the absorption of bacterial substances, or from the production of bacterial products anywhere in the body

The nature of the bacterial allergen is also a matter of argument and speculation A workable hypothesis is perhaps that of Zinsser, who stated, "Bacterial allergy is a hypersensitiveness to the somatic protein antigens of bacteria, in which the cells become sensitized by the liberation of an unchanged protein bacterial substance in the lesions"

In this report we shall confine ourselves to the allergy which, we believe, develops from infections in the upper respiratory tract Although careful aerobic and anaerobic cultures were made from the infected material obtained from the various foci, no attempt is made to denounce any one micro-organism or groups of micro-organisms as the responsible agent The reason is that the methods available to prove such a causative relationship are still grossly inadequate when we deal with the ordinary pathogenic bacteria In our experience, skin tests to filtrates or vaccines made from such organisms have proven very disappointing, and the results of such tests were in no way commensurate with the degree of the existing bacterial hypersensitiveness This applies also to nonpathogenic airborne bacteria, although with the latter, skin tests seem to be more reliable,[4] furthermore, the efficacy of vaccine therapy will not be assayed in the group of patients It should be stated, however, that a great number received vaccines prepared from organisms obtained from the surgically removed infected material

Material This group comprises 911 patients who were studied in the hospital or outpatient clinics during the past 18 years Many more patients could be included, but the report is limited to those whom we were able to follow for at least five years after the necessary surgical procedure had been instituted It is needless to say that it was the cooperation of Dr W W Eagle and his staff that so greatly facilitated the handling of these patients To further facilitate matters, this group of 911 patients has been broken down into five categories, namely, those who were essentially asthmatics, those patients who suffered from atopic, allergic or perennial rhinitis, and those who sought relief from either urticaria or angioneurotic edema. It is obvious that several of the patients were sufferers from more than one of the common major allergic disorders, but they are classified according to their main presenting complaint.

Asthma. This group comprises 355 patients, ranging in age from seven years to 65 or more years. The incidence of otolaryngological complications is tabulated below.

TABLE 1. ASTHMA

No. Pats.*	Age (Yrs.)	Nose and Throat Complications No.	Nose and Throat Complications Yes	Type	No.	Per Cent
15	7-15	9	6	Tonsillitis and adenoiditis	4	40
				Sinusitis, ethmoid	1	
				Sinusitis, antral	1	
58	16-25	35	23	Tonsillitis and adenoiditis	5	39
				Sinusitis, single	7	
				Sinusitis, multiple	3	
				Polyps, nasal	5	
				Polyps, antral	2	
				Polyps and sinusitis	2	
				Recurrent bronchitis	10	
159	26-45	91	66	Tonsillitis and adenoiditis	20	42
				Sinusitis, single	18	
				Sinusitis, multiple	26	
				Polyps, nasal	18	
				Polyps, antral	16	
				Polyps and sinusitis	19	
				Recurrent bronchitis	52	
123	46-65	28	95	Sinusitis, single	12	77
				Sinusitis, multiple	43	
				Polyps, nasal	26	
				Polyps, antral	37	
				Polyps and sinusitis	38	
				Recurrent bronchitis	93	
355			192			55

*Unselected consecutive ambulatory or hospitalized patients.

Although the number of patients in the prepuberty age is small, it is apparent, and in agreement with most clinicians, that tonsillitis and adenoiditis are the most common offenders As the patients grow older, complications such as sinusitis, with or without polyposis, and recurrent tracheobronchitis become more frequent In 159 young adults, single or multiple sinusitis occurred in 44, and recurrent tracheobronchitis in 52 patients It has been said that an allergic sinusitis is usually multiple, whereas a pyogenic (suppurative) sinusitis often affects only one of the paranasal cavities

The importance of chronic and acute sinus infections in asthma and tracheobronchial-pulmonary infections has been repeatedly emphasized[5-8] There is no question that sinus infection is common in many asthmatics and that it undoubtedly plays an important rôle in the infective (allergic) type of asthma This may well apply also to the incidence of recurrent tracheobronchitis,[10 11] and, through sensitization of the pulmonary alveolar cells to the more obscure types of allergic pulmonary responses, such as Loeffler's syndrome[12] The incidence of nose and throat complications bears a definite relationship to the duration of asthma in a given patient This is shown in the following table

TABLE 2 RELATION OF THE DURATION OF ASTHMA TO THE INCIDENCE OF NOSE AND THROAT COMPLICATIONS *

Duration of Asthma in Years	No Pats	No Pats with N & T Complications	Per Cent
1 5	43	11	26
6 10	134	44	31
11 15	91	74	81
16 20	49	37	80
21 35	38	29	76

*Deflection of the nasal septum is excluded as a complication

It is, of course, difficult to state unequivocally which preceded the other The fact remains that in our group of asthmatics with nose and throat complications the highest incidence of such infections was observed in those patients who had suffered from asthma for more than 10 years (80 per cent) This does not imply, of course, that three out of four patients who have suffered from asthma for more than 10 years will necessarily be afflicted by infections in the paranasal sinuses or upper respiratory tract

Of these groups of 355 asthmatic patients, 192 had some type of rhinological or bronchial infection Of these, 152 patients were subjected to some form of operation, ranging from the submucous resection of the nasal septum to a Caldwell-Luc operation, single or bilateral, on the antral sinuses The incidence of nose and throat complications and of surgical interference in this group may seem high, but it should be emphasized that the department of allergy and the otolaryngological department at Duke Hospital work in such close cooperation that the study of an asthmatic or any other allergic patient is not considered complete until a nose and throat surgeon has examined the patient

The effect of the operative procedures in the 152 asthmatic patients is influenced by the duration of asthma as summarized in the third table

TABLE 3 SUMMARY OF THE RESULTS OF NOSE AND THROAT OPERATIONS IN ASTHMATIC PATIENTS

No Pats with N & T Disease	No Pats Operated Upon	Good (+)	Results Improved (?)	Failure (0)	Per Cent Benefited (+, ?)
Group A (1 5 Yrs)	9	5	4	—	100
Group B (6 15 Yrs)	105	57	16	32	70
Group C (16 35+ Yrs)	38	17	10	11	73
Totals	152	79	30	43	69

This is, perhaps, in accord with what has been stated previously, namely the incidence and extent of the nose and throat complications is greater in patients who have suffered from asthma for a long time A number of the patients had more than one operation (A, B, C) A relatively small group[11] had suffered from asthma less than five years, and the result of surgery in these patients can be described as excellent

The largest group (118 patients) had been asthmatics for from six to 15 years, and of these, 40 were not improved, whereas the rest (78) were strikingly or definitely benefited. The group of patients (66) who had been asthmatics for more than 16 years showed a higher percentage of failures following surgical interventions It is, of course, difficult to evaluate beneficial results This depends on the interpretation of the observer and the relative statistics will necessarily vary with the reports of different clinics Our criteria in the younger patients were the days lost from school because of asthma or recurrent upper respiratory infections, their ability to exercise and to participate in athletics, and in the older patients, the frequency of asthmatic seizures, head or chest colds, breathlessness and the degree of pulmonary reserve as indicated by the chest expansion, vital capacity and expiration time Although no accurately measurable data were possible, our clinical evaluation of the efficacy of nose and throat operations in the asthmatic group summarized below:

TABLE 4 RELATION OF THE DURATION OF ASTHMA TO THE EFFECT OF OPERATIVE NOSE AND THROAT PROCEDURES

Duration (Yrs) No Pats with N & T Disease	Operative Procedures	No Pats Treated	No of Operations	[illegible]	[illegible]	[illegible]
1 5 (11) A	T & A	A 5	5	—	2	2
	*T & A and Caldwell Luc	2	2	—	—	2
	Submuc Resc.	1	1	—	1	—
	Submuc Resc. & Ethmoidec	1	1	—	[illegible]	—
	Submuc Resc & T & A	A 2	2	—	—	2
6-15 (118)	T & A	B-25	25	7	2	16
	T & A — Caldwell Luc	B-[illegible]	[illegible]	—	2	6
	Submuc Resc.	2[illegible]	2[illegible]	7	2	11
	Submuc Resc	B-4	[illegible]	—	1	[illegible]
	Submuc Resc — Caldwell Luc	2[illegible]	2[illegible]	[illegible]	2	18
	Caldwell Luc	B-2[illegible]	20	9	6	6
16 35— (66) C	T & A	21	21	9	10	12
	Submuc Resc	2	2	—	2	—
	Submuc. Resc — Caldwell Luc	C-19	19	6	5	8
	Submuc Resc — Ethmoidec.	C-14	14	3	4	7
	Caldwell Luc	8	8	2	2	4

It was our impression that 69 per cent of the 152 asthmatic patients who were subjected to rhinological procedures were benefited As already stated, the great majority of these patients received, also, injections of an autogenous vaccine, and there is little doubt that vaccine therapy is efficacious, not only in treating allergic bacterial pulmonary disease,[4 13] but perhaps also in certain instances of sinusitis[14]

Bronchoscopy has been used by us rarely as a therapeutic measure, but frequently as a diagnostic aid Undoubtedly it may prove beneficial in certain instances of asthma[15]

Allergic Rhinitis This group comprises those patients whose nasal symptoms were due not only to an evident demonstrable inhalant, contact or ingestant allergy, but also in whom a bacterial type of allergy was strongly suspected by history In many of these patients pathogenic organisms, such as Beta hemolytic streptococci, pneumococci or influenza organisms, were easily grown in cultures from the nasal passages or pharynx, furthermore, subsequent surgical procedures often re-emphasized and proved the existence of an infection as a contributory cause of the nasal allergy In our opinion, the appearance of the nasal mucosa of these patients is usually not only edematous but also quite hyperemic The incidence of demonstrable nose and throat complications in this group of patients is shown below

TABLE 5 ALLERGIC RHINITIS

No Pats *	Age (Yrs)	Nose and Throat Complications No	Yes	Type	No	Per Cent
38	10 20	32	6	Septal deflection	2	15
				Tonsillitis, adenoiditis	4	
				Sinusitis, single	1	
				Nasal polyps	1	
64	21 35	43	21	Septal deflection	14	32
				Sinusitis, single	15	
				Sinusitis, multiple	2	
				Nasal polyps	3	
				Sinusitis and polyps	5	
112	36 50	48	64	Septal deflection	37	58
				Sinusitis, single	48	
				Sinusitis, multiple	10	
				Nasal polyps	18	
				Sinusitis and polyps	24	
73	51 65	32	41	Septal deflection	21	55
				Sinusitis, single	18	
				Sinusitis, multiple	23	
				Nasal polyps	19	
				Sinusitis and polyps	27	

As expected, the great majority of these patients, with nose and throat complications, had a deflected nasal septum The incidence of this anomaly, in our group, seems to diminish with age, due in part at least to previous operative repair Of the 287 patients with allergic rhinitis, 74 were thought to have insufficient nasal breathing spaces because of an anomaly of the nasal septum In this connection it must be remembered that nasal obstruction and mouth breathing have been incriminated as causes of sinusitis in children[16] This is particularly true of children below six years, the age at which the mandible begins to grow rapidly to accommodate the permanent teeth Tonsillitis and adenoiditis and then sinusitis, single or multiple, were the next most common complications It is obvious that adenoiditis, or its equivalent, such as lymphoid hyperplasia in the nasopharynx, when combined with a deflection of the nasal septum, will further increase the incidence of sinusitis, particularly in the young patients, however, the latter was a very common complication in the middle-aged and older group of our patients with allergic rhinitis The results of nose and throat surgery in these patients with proven nose and throat complications is tabulated as follows

TABLE 6 THE EFFECT OF NOSE AND THROAT SURGERY IN ALLERGIC RHINITIS

No Pats with N & T Disease*	Patients Treated Surgically	Operations—Type	No Pts	Results 0	Results ?	Results +	Per Cent* Benefited
132	128	1) Submucous Resc	52	18	19	15	65
		2) T & A	4	1	—	3	75
		3) Polypectomy	29	7	10	22	82
(287)		4) Ethmoidectomy + or sphenoidectomy	26	16	3	7	38
		5) Caldwell Luc	17	11	3	3	35
		6) 1 + 2	46	17	20	9	63
		7) 1 + 3	63	10	18	35	87
		8) 1 + 4	51	3	24	24	94
		9) 1 + 5	19	2	5	12	89
132	128		128		85		66

*Percentage calculated on fair as well as excellent results

Of the 287 patients with allergic rhinitis, 132 were found to have some type of nose and throat affection, and of these, 128 were treated surgically As was expected, the great majority had a submucous resection of the nasal septum or some similar operation, and of these, 65 3 per cent were definitely benefited Tonsillectomies and adenoidectomies alone were rather few, perhaps because the majority of these patients were past puberty Polypectomies, ethmoidectomies and sphenoidectomies were done on 55 patients with excellent results A Caldwell-Luc procedure was done on 17 patients with a beneficial result in 35 2 per cent, combined or multiple operations were performed on the majority of these persons with an overall apparent beneficial result in 66 4 per cent of the 128 patients surgically treated Again, most, if not all, of these patients were treated with desensitizing and autogenous vaccine mixture, yet we feel that the beneficial results reported were due in great part to the necessary surgical procedures

Perennial Rhinitis These patients, 93 in all, presented a most difficult and trying problem They complained of more or less constant nasal discomfort, and the history is rarely of any help in solving their problem Undoubtedly, patients with so-called X-hay fever, as well as many with psychosomatic disturbances, are found in this category[17] In 49 of the 93 patients, some type of nose and throat complication was diagnosed This is an incidence of over 50 per cent and is summarized in the next table

It is obvious that the types of rhinological abnormalities encountered in this group differ little from those found in the patients with allergic rhinitis, although the occurrence of sinusitis and polyposis in the patients with perennial rhinitis is perhaps higher, particularly in the older age group Surgical procedures were performed in 44 of 49 patients who were

TABLE 7 PERENNIAL RHINITIS *

No Pats †	Age (Yrs)	Nose and Throat Complications		Type	No	Per Cent
		No	Yes			
14	20 30	5	9	Tonsillitis & adenoiditis	4	
				Septal deflection	8	
				Nasal polyps	1	64
				Sinusitis single	3	
				Sinusitis multiple	2	
52	31 50	31	21	Tonsillitis & adenoiditis	5	
				Septal deflection	14	
				Nasal polyps	8	40
				Sinusitis single	7	
				Sinusitis multiple	9	
27	51 65	8	19	Tonsillitis & adenoiditis	1	
				Septal deflection	3	
				Nasal polyps	9	70
				Sinusitis single	3	
				Sinusitis, multiple	14	
				Polyps & sinusitis	5	
93			49			52

*This group includes undoubtedly examples of so-called vasomotor rhinitis
†Unselected consecutive ambulatory and hospitalized patients

found to have some infection or other complication in the upper respiratory tract, this means that 89 per cent were treated surgically Again, a submucous resection of the nasal septum was the most frequent procedure, but other measures, such as polypectomies and various sinus operations, did not lag far behind Beneficial results ascribed in great part to surgery were observed in 25 patients, or 56 8 per cent of this group See table below

TABLE 8 THE EFFECT OF NOSE AND THROAT SURGERY IN PERENNIAL RHINITIS

No Pats with N & T Disease*	Patients Treated Surgically	Operations—Type	No Pts	Results 0	Results ?	Results +	Per Cent* Bene fited
49	44	1) Submucous resc	6	2	2	2	67
		2) T & A	6	2	2	2	67
		3) Polypectomy	2	2	—	—	0
		4) Ethmoidectomy + or sphenoidectomy	4	3	1	—	25
		5) Caldwell Luc	3	3	—	—	0
		6) 1 + 2	5	2	1	2	60
		7) 1 + 3	5	2	2	1	60
		8) 1 + 4	4	1	2	1	75
		9) 1 + 5	5	1	2	2	80
		10) 2 + 5	4	1	1	2	75
49			44		25		57

*Percentage calculated on fair as well as excellent results

Atopic Rhinitis These are patients who suffer from purely seasonal rhinitis Their family and past personal history characterizes them as truly hypersensitive or atopic individuals Yet, among these 74 individuals, there were 24 in whom a careful nose and throat examination disclosed the presence of some anatomical or infectious complication

TABLE 9 ATOPIC RHINITIS (PURE*)

No Pats	Age (Yrs)	Nose and Throat Complications No	Nose and Throat Complications Yes	Type	No	Per Cent
12	6 15	10	2	Septal deflection	1	18
				Adenoids, etc	2	
33	16 30	21	12	Septal deflection	7	21
				Adenoids, etc	3	9
				Sinusitis	2	6
14	31 55	7	7	Septal deflection	4	29
				Adenoids, etc	1	8
				Sinusitis	2	1
5	56+	2	3	Septal deflection	0	0
				Adenoids, etc	1	20
				Sinusitis	2	40

*Purely seasonal history

It is not surprising that an anomaly of the nasal septum leads the list On the other hand it is obvious that the complications of a bacterial nature, such as sinusitis increase with the age of the patient The effect of nose and throat surgery in such patients is excellent See the following table:

TABLE 10 The EFFECT OF NOSE AND THROAT SURGERY IN ATOPIC RHINITIS (PURE*)

No. Pats. with N & T Disease	Patients Treated Surgically	Operations—Type	No. Pts.	Results			Per Cent Benefited
				[illegible]	[illegible]	—	
24	11	Submucous resection	7	2	1	4	71
		Adenoiditis etc.	3	—	1	2	100
		Sinus operation	3	1	1	1	57

*Purely seasonal by history

Of the 24 patients with atopic rhinitis who were found to have some infection or anatomical abnormality of the nose and throat, 11 were treated surgically. Even though the group is small, the results speak for themselves In this group, again, the removal of an anatomical obstruction by a submucous resection of the nasal septum, and the eradication of foci of infection, most often in the adenoids, proved very beneficial

Urticaria and Angioneurotic Edema The problem of urticaria and angioneurotic edema is perhaps the most trying, and the treatment of patients afflicted with one or both of these major allergies is most difficult We refer to adults and to those patients in whom a psychic conflict is not the obvious cause In our experience, bacterial allergy is the most important precipitating agent.[13] In our group of 112 patients some form of bacterial infection was found in 13, or about 38 per cent See the next table surgery were observed in 25 patients, or 56 8 per cent of this group See table below

TABLE 8 THE EFFECT OF NOSE AND THROAT SURGERY IN PERENNIAL RHINITIS

No Pats with N & T Disease*	Patients Treated Surgically	Operations—Type	No Pts	Results 0	Results ?	Results +	Per Cent* Benefited
49	44	1) Submucous resc	6	2	2	2	67
		2) T & A	6	2	2	2	67
		3) Polypectomy	2	2	—	—	0
		4) Ethmoidectomy + or sphenoidectomy	4	3	1	—	25
		5) Caldwell Luc	3	3	—	—	0
		6) 1 + 2	5	2	1	2	60
		7) 1 + 3	5	2	2	1	60
		8) 1 + 4	4	1	2	1	75
		9) 1 + 5	5	1	2	2	80
		10) 2 + 5	4	1	1	2	75
49			44		25		57

*Percentage calculated on fair as well as excellent results

Atopic Rhinitis These are patients who suffer from purely seasonal rhinitis Their family and past personal history characterizes them as truly hypersensitive or atopic individuals Yet, among these 74 individuals, there were 24 in whom a careful nose and throat examination disclosed the presence of some anatomical or infectious complication

TABLE 9 ATOPIC RHINITIS (PURE*)

No Pats	Age (Yrs)	Nose and Throat Complications No	Nose and Throat Complications Yes	Type	No	Per Cent
12	6 15	10	2	Septal deflection	1	18
				Adenoids, etc	2	
33	16 30	21	12	Septal deflection	7	21
				Adenoids, etc	3	9
				Sinusitis	2	6
14	31 55	7	7	Septal deflection	4	29
				Adenoids, etc	1	8
				Sinusitis	2	1
5	56+	2	3	Septal deflection	0	0
				Adenoids, etc	1	20
				Sinusitis	2	40

*Purely seasonal history

It is not surprising that an anomaly of the nasal septum leads the list On the other hand, it is obvious that the complications of a bacterial nature, such as sinusitis, increase with the age of the patient The effect of nose and throat surgery in such patients is excellent See the following table

TABLE 10 The EFFECT OF NOSE AND THROAT SURGERY IN ATOPIC RHINITIS (PURE*)

No Pats. with N & T Disease	Patients Treated Surgically	Operations—Type	No Pts.	Results			Per Cent Benefited
				0	?	+	
24	11	Submucous resection	7	2	1	4	71
		Adenoiditis etc	3	—	1	2	100
		Sinus operation	3	1	1	1	67

*Purely seasonal by history

Of the 24 patients with atopic rhinitis, who were found to have some infection or anatomical abnormality of the nose and throat, 11 were treated surgically Even though the group is small, the results speak for themselves In this group, again, the removal of an anatomical obstruction by a submucous resection of the nasal septum, and the eradication of foci of infection most often in the adenoids, proved very beneficial

Urticaria and Angioneurotic Edema The problem of urticaria and angioneurotic edema is perhaps the most trying, and the treatment of patients afflicted with one or both of these major allergies is most difficult We refer to adults and to those patients in whom a psychic conflict is not the obvious cause In our experience, bacterial allergy is the most important precipitating agent[15] In our group of 112 patients, some form of bacterial infection was found in 43, or about 38 per cent See the next table

TABLE 11 URTICARIA AND ANGIONEUROTIC EDEMA AND THE INCIDENCE OF NOSE AND THROAT AND OTHER INFECTIONS

No Pats	Age	Nose and Throat Complication	No Pats with Corresponding N & T Disease	Other Complications
18	15 20	Tonsillitis and adenoiditis Sinusitis, etc	10 3	Dental 1 Gall bladder 1 Unknown 3
39	21 35	Tonsillitis and adenoiditis Sinusitis, etc	8 9	Dental 8 Gall bladder 6 Prostate 2 Unknown 6
31	36 55	Tonsillitis and adenoiditis Sinusitis, etc	2 8	Dental 9 Gall bladder [illegible] Prostate 1 Unknown 4
24	56+	Tonsillitis and adenoiditis Sinusitis, etc	2 1	Dental 1 Gall bladder 5 Prostate 1 Unknown 14

The site of the foci of infection in this group of patients is quite variable In the older age group, infections in the sinuses, teeth, gall bladder and prostate are increasingly more numerous The patients with this type of an allergic disorder should have a thorough medical survey, and the exactness of such an examination will usually determine whether patients with these allergic disorders are helped or left to suffer

Summary and Conclusions We have studied patients who were unselected examples of one or more of the major allergic disorders Of these 911 people, 440 had some type of anatomical or infectious complication in the upper respiratory tract

TABLE 12 INCIDENCE OF NOSE AND THROAT COMPLICATIONS IN FIVE MAJOR ALLERGIC DISORDERS

Allergic Manifestations	No Pats	No Pats with Nose & Throat Complications	Per Cent
Atopic rhinitis	64	24	38
Allergic rhinitis	287	132	46
Perennial rhinitis	93	49	53
Asthma	355	192	54
Urticaria and angioneurotic edema	112	43	38

Of the 440 patients, 315 were operated upon. In many instances multiple surgical procedures were necessary Although it is difficult to evaluate mathematically, the results of the indicated otolaryngological treatment, the analysis of our group of allergic individuals suggests that it was beneficial in at least 50 per cent of the patients The primary indication for surgical intervention in allergic people is founded on our growing understanding of the existence of bacterial allergy The difficulties in proving the existence of bacterial allergy by the methods now available are obvious, therefore, we must rely on clinical observation to evaluate the efficacy of surgical procedures which were done to eradicate foci of infection in allergic patients

Sixty-nine per cent of asthmatics, an almost identical percentage of patients with allergic rhinitis, and a smaller percentage (56 8 per cent) of sufferers from perennial rhinitis were benefited by the necessary surgical nose and throat procedures The operations carried out upon patients with atopic rhinitis were even more successful In the patients affected with urticaria and/or angioneurotic edema, the results of rhinological operations were by far less decisive There are undoubtedly other otolaryngological disturbances which are probably of an allergic nature,[2] but we have confined ourselves necessarily to the more common major allergic manifestations

1 The incidence of otolaryngological complications in allergic individuals is high.

2 In a group of asthmatic patients it amounted to 55 per cent, the frequency of such complications growing with the age of the patient and the duration of asthma

3 Beneficial results of the nose and throat operations in asthmatic patients were observed in 69 per cent of 152 patients out of 195 asthmatics with nose and throat complications

4 In a group of 287 patients with allergic rhinitis 1[illegible]2 were found to have some infection or anatomical abnormality

"THE FUNCTION OF THE EAR IN HEALTH AND DISEASE"

Unusual Educational Sound and Color Film, Edited by
H G Kobrak, M D, Ph D, Joseph E Hind and
Robert B Miller, M D

This film was produced at the University of Chicago and its purpose is to demonstrate the response of the ear to sound in health and disease The range which the ear can perceive is demonstrated The minimum and maximum intensity of sound recorded by the ear is shown Pathology of the middle ear is demonstrated on diseased temporal bones The vibrating eardrum after paracentesis is demonstrated The inflation after Politzer and the effect on the eardrum is shown

Hearing curves of certain types of deafness are shown and the response of the ear is demonstrated By using electronic filters, the sound perception of a diseased ear is given in the sound track similar to the actual hearing defect, therefore, the audience is able to see the pathologic function on the screen and simultaneously hear the distorted acoustic signal which the patient perceives

The audiometric hearing curve of a patient obtained before fatal termination of his disease is shown The acoustic vibrations of this diseased temporal bone are demonstrated

The action of hearing aids and intensity changes due to the action of the hearing aid is demonstrated The reflex of the middle ear muscles is demonstrated in animal experiments and in patients The utilization of the stapedius reflex for objective hearing tests is demonstrated

This is the first film of its kind ever attempted and successfully accomplished for visual education in otology

The film is available to medical societies, hospitals, universities and professional study groups without charge through the Auralgan Research Division, 100 Varick Street, New York 13, N Y

STATE UNIVERSITY OF IOWA COURSE IN CLINICAL AUDIOMETRY

An intensive two weeks' course in Clinical Audiometry will be offered at the State University of Iowa, June 14 to 28, 1949 The course will be conducted daily from 8 00 to 5 00 and will include lectures on audiometry, lip-reading, speech training for the hard of hearing, psychological problems of the acoustically handicapped and clinical otolaryngology, laboratory work, including observation and participating in hearing testing and hearing aid fittings for clinical patients in the Department of Otolaryngology and Oral Surgery, State University of Iowa Hospital, observation of the university's comprehensive speech pathology program, and special pictures and demonstrations by Prof John S Steinberg, of the Bell Telephone Laboratories, and Mrs Bernice Rutherford, of the Rehabilitation Center, St Paul, Minn

One of the Iowa Hearing Clinics, involving medical, psychological, speech, audiometric and social work approaches to cases assembled by the Department of Otolaryngology and Oral Surgery, the Iowa State School for the Deaf, and the Speech Clinic will be scheduled during the intensive course

For further information address Prof Wendell Johnson Director, Speech Clinic, State University of Iowa, Iowa City Iowa

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp, 580 Fifth Ave, New York 19 N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St, Chicago, Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St, Chicago Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5 N Y

Electroear Model C

Manufacturer American Earphone Co, Inc, 10 East 43rd St., New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc 50 W 29th St, New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co Inc, North Third St, Minneapolis, Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp, 1 W 34th St. New York N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co 727 Atlantic Ave Boston 11 Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co 4602 Nicollet Ave Minneapolis 9 Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories 815 S Hill St Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4

Manufacturer Otarion Hearing Aids, 159 N Dearborn St Chicago Ill

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)

Manufacturer Paraphone Hearing Aid Inc 2056 E 4th St Cleveland Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co 850 W Oakdale Chicago 14 Ill

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone

Manufacturer E A Myers & Sons 306 Beverly Rd Mt. Lebanon Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp 6001 W Dickens Ave Chicago Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp 101 Tremont St. Boston 8 Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc 2151 S Michigan Ave Chicago Ill

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex, Inc, Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters, Inc, 1627 Pacific Ave, Dallas 1, Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm, Inc, 400 W Lake St, Libertyville, Ill

Unex Model "A"

Manufacturer Nichols & Clark, Hathorne, Mass

Vactuphone Model 3

Manufacturer Allen Howe Electronics Corp, Salem, Mass

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc 120 Broadway, New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3 A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp, 6001 Dickens Ave Chicago, Ill

All of the accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer 20 Charlesgate West Boston 15 Mass
Secretary Dr Gordon D Hoople Medical Arts Bldg, Syracuse 3 N Y

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A. Fenton 906 Medical Arts Bldg Portland Ore
Secretary Louis H. Clerf, 1530 Locust St., Philadelphia 2 Pa.
Meeting San Francisco Calif., 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin 384 Post St. San Francisco 8 Calif
Secretary Dr C Stewart Nash 708 Medical Arts Building Rochester N Y

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

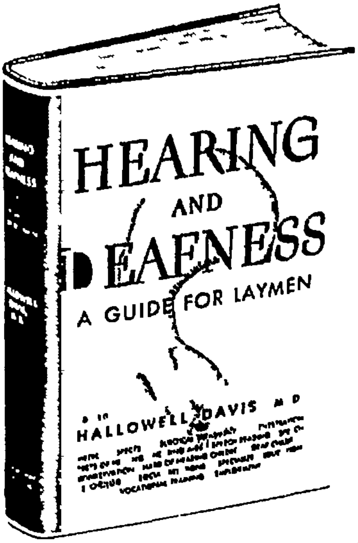
Chairman Dr Fletcher D Woodward 104 E. Market St., Charlottesville Va.
Secretary Dr James M Robb 641 David Whitney Bldg Detroit, Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens 35 E 70th St., New York, N Y
President Elect Dr J Mackenzie Brown 1136 W 6th St. Los Angeles Calif.
Executive Secretary Dr William L. Benedict, Mayo Clinic Rochester Minn.

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E. Ashley 384 Post St., San Francisco Calif
Secretary Treasurer Dr Joseph Hampsey 806 May Bldg., Pittsburgh 22 Pa.



The answers to problems of DEAFNESS

for the hard of hearing
and those who
work with them

JUST PUBLISHED

HEARING AND DEAFNESS

Edited by HALLOWELL DAVIS, M D

Director of Research Central Institute for the Deaf Research Professor of Otolaryngology, Washington University School of Medicine

A MURRAY HILL BOOK
496 pages, 6 x 8½, 142 helpful illustrations, $5 00

Expert guidance from 14 specialists

1 AUDIOLOGY A MEETING OF VARIED SPECIALISTS
2 PHYSICS AND PSYCHOLOGY OF HEARING
3 ANATOMY AND PHYSIOLOGY OF THE EAR
4 MEDICAL ASPECTS OF HEARING LOSS
5 SURGICAL TREATMENT OF HEARING LOSS
6 TESTS OF HEARING
7 HEARING AIDS
8 THE CHOICE AND USE OF HEARING AIDS
9 SPEECH READING
10 AUDITORY TRAINING
11 CONSERVATION OF SPEECH
12 MILITARY AURAL REHABILITATION
13 FROM ARISTOTLE TO BELL
14 HARD-OF-HEARING CHILDREN
15 DEAF CHILDREN
16 THE PSYCHOLOGY OF THE HARD-OF HEARING AND THE DEAFENED ADULT
17 ORGANIZATIONS FOR THE AURALLY HANDICAPPED
18 EMPLOYMENT FOR THE HARD OF HEARING
19 VOCATIONAL GUIDANCE FOR THE DEAF

HERE, in a single, easily-understood volume, is intensely practical guidance in dealing with the many physical, social and economic handicaps of deafness Edited by Dr Hallowell Davis, HEARING AND DEAFNESS was written in collaboration by 14 experts. Each brings the latest advice and information on that particular phase of the subject with which years of specialization have best equipped him or her to deal Their aim is to help hard-of-hearing people in the most practical way possible by making them fully informed by guiding them in seeking relief through modern scientific developments, by helping them avoid useless expenditures and disappointments, and, finally, if relief is not forthcoming, to retain speech powers, to hold jobs and otherwise live as normally as possible

Primarily written for the sufferers themselves, the book is of equal value to physicians, educators, sociologists and families of hard-of-hearing victims—to all who must, in one way or another, play a part in alleviating this distressing condition

" should be in the hands of all the thousands of those who ask the questions and want to get the correct answers "

—C STEWART NASH President American Hearing Society

" Here, at last, is information, correct, easy to read, covering nearly every phase of the problem in a manner suited to laymen HEARING AND DEAFNESS should be the means of greatly lessening the handicap of deafness "

—LOUISE TRACY The John Tracy Clinic

Order from

The Laryngoscope
640 So Kingshighway St. Louis 10, Mo.

THE
LARYNGOSCOPE.

VOL LIX JUNE, 1949 NO 6

TUMORS OF THE PAROTID GLAND *†‡

ROBERT W BUXTON, M D , JAMES H MAXWELL, M D ,
and DONALD R COOPER, M D ,

Ann Arbor, Mich

This analysis of 227 patients with primary tumors of the parotid gland is presented in an effort to add a note of optimism to the prognosis of these lesions It is indeed difficult to explain the great differences of opinion which exist regarding treatment of these tumors, the marked variation in our ability to eradicate them completely and permanently, and the high incidence of surgical complications after extirpation of a tumor so readily accessible [1-5]

The pessimistic attitude which has developed has much to support it A lack of exact knowledge of the anatomy of the facial nerve and its important branches has made the possibility of surgically produced facial palsy a formidable hazard when removal of a parotid tumor is undertaken Once removed, these tumors are said to recur and with each recur-

---

*Read at the Fifty third Annual Meeting of the American Laryngological Rhinological and Otological Society Inc Chicago Ill April 20 1949

†Presented in part before the Society of University Surgeons San Francisco Calif March 24 26 1949

‡From the Departments of Otolaryngology and Surgery University of Michigan Medical School Ann Arbor Mich

Editor s Note This ms received in Laryngoscope Office and accepted for publication April 21 1949

rence an increased rate of growth, increased cellularity and possibly a change from benignancy to malignancy may result.[6, 14] As a corollary to this it has been indicated that benefit from excision of such malignant lesions is slight;[6] furthermore, much confusion has arisen from the great variety of terms employed by the pathologist in describing these tumors. His difficulty in distinguishing histologically the benign from the malignant lesions has contributed no little part to the surgeon's difficulty in planning suitable treatment.

The ultimate in pessimistic conservatism has been reached when, on the basis of these reasons, physicians have stated that it is wiser not to operate upon these patients as long as they are willing to wait, that the only unequivocal indications for operation are pain and limitation of mandibular movement, and that if the tumor is carcinoma, "its excision usually fails to afford much benefit."[3, 6]

We are of the opinion that the presence of a new growth in the parotid gland is an indication for its removal. In the more than 14 years between July, 1934, and January, 1949, 227 patients with primary tumors of the parotid gland have been admitted to the University of Michigan Hospital. One hundred nineteen of these were treated in the department of otolaryngology and 108 in the department of surgery. Nine of these individuals were seen in consultation only, after operation elsewhere. Some type of operation upon the involved parotid gland was thus carried out on 218 patients in this period. Pathologic material was available on all patients and all have been followed to the present time.

Little value would be derived here from an elaborate discussion of the histogenesis of tumors of the parotid gland. It seems to us that the significance of such studies is often exaggerated. Nor does it seem profitable to enter into an extended defense or discussion of the particular histologic classification used in this hospital.

The majority of patients (113) in this study had tumors of the mixed salivary gland type, which are so classified without further description of the predominant cellular elements present in each tumor The second largest group of patients (54) are those whose tumors contained the typical mixed tumor elements, but in which the cellular changes, degree of capsular penetration or extent of infiltration of adjacent parotid gland indicated active infiltrative growth to the extent that they have been classified as carcinomas (or sarcomas) arising in a mixed salivary tumor The third largest group of patients (41) are those with tumors composed entirely of malignant cells in which any suggestion of origin from the benign mixed tumor is absent Among the last two histologic groups appear three tumors with the typical pseudoadenomatous basal cell configuration,[7] in two of these, origin in a mixed tumor is apparent The pathologic material from 16 patients, also included in the malignant tumor groups, was classified as epidermoid or squamous cell in type In two instances the term mucoepidermoid was used to define the pathologic appearance[8] One of these latter two patients had distant metastases at the time of his death

Ten patients in this series had tumors designated as papillary cystadenoma lymphomatosum[9] This unusual tumor, like the mixed tumor, has a debatable histogenesis Microscopically, it is composed of tall papillary epithelial projections embedded in lymphoid stroma which may contain germinal centers It is a wholly benign lesion, more common in men than in women, and its histologic characteristics are unmistakable

The sarcomas of the parotid gland are rare tumors with no distinguishing clinical characteristics There exists some doubt[10] whether these are true connective tissue neoplasms or are highly undifferentiated tumors of epithelial origin

Suspicion exists in the minds of many surgeons that repeated excision of a benign parotid tumor may lead ultimately to malignancy Such a thesis is difficult to prove, since obvious and unequivocal evidence of this change is seldom seen We have been able to find only three patients in whom definite change from a benign to a malignant lesion can be demonstrated In one patient a benign mixed salivary tumor of the parotid gland was removed in 1928, recurred in 1933 and, when removed again in 1938, was found to be a poorly differentiated medullary carcinoma A similar instance occurred in another patient 12 years after the appearance of the original tumor and nine years after the first removal At the second operation a carcinoma, arising in a mixed salivary gland tumor, was found The third patient's mixed tumor was removed in 1927, recurred in 1939 and was removed here in 1943 At this time carcinomatous change was present within the tumor A second recurrence, present since December, 1948, has now caused this patient to be readmitted Such instances must be interpreted guardedly since serial sections of the original tumor might well display evidences of malignancy not apparent in the histologic sections examined Three additional patients with malignant tumors are known who are reported to have had benign lesions originally, but factual evidence of the benignancy of the early lesion has been unobtainable Many examples exist, here and elsewhere, of repeated excisions of a benign lesion in which no evidence of malignancy at a later operation was discovered The evidence that change from a benign to a malignant tumor does occur seems to rest, then, in the tumor known to be present, 10, 15 or 20 years, in which histopathologic evidences of malignancy are seen, however, it seems unlikely that, when malignant, these tumors would remain localized as long as 10 to more than 20 years Inspection of Table III suggests that when only the known duration of the tumor is considered, there is a rather uniform incidence of all carcinomas in this series up to the four to six-year periods From our knowledge of these tumors such duration is not unlikely and it may be assumed that malignant elements may be present within the tumors during the entire period The incidence then falls off as shown in this table until the 10 to 20-year periods are reached This suggests that a benign tumor had existed 10, 15 or 20 years, that change in its growth or appearance prompted medical consultation and that this change resulted from malignant degeneration in the mixed tumor apparent to the pathologist after removal of the tumor Similar conclusions might be drawn from the primary carcinoma group where evidence of a pre-existing benign lesion might be obscured by rapid growth of the malignant cells The data presented here suggests, therefore, that time, rather than the trauma of repeated operation, may be the greater factor in the appearance of malignancy in a benign mixed tumor

The clinical manifestations of parotid gland tumors usually make their diagnoses obvious This is particularly true when the tumor lies in the superficial portion of the gland Those tumors arising in the gland behind the ramus of the mandible and deep to the facial nerve are less readily defined and infiltration into adjacent gland or fixation to neighboring structures is demonstrated with difficulty Tumors in the latter area may fill the lateral pharyngeal space and are commonly much larger than anticipated

The symptoms presented by the patients in this series are varied but were always concerned with the presence of a tumor (see Table I) The occurrence of pain or tenderness over the tumor or radiating over the side of the face was of little value in differentiating the malignant lesions On the other hand, the appearance of facial palsy not produced by prior surgical trauma always indicated invasion of the nerve

SYMPTOMS

	MIXED TUMORS	CARCINOMA IN MIXED TUMORS	CARCINOMA	SARCOMA IN MIXED TUMORS	SARCOMA	PAPILLIFEROUS CYSTADENOMA LYMPHOMATOSUM
TUMOR	76	30	17	6	0	6
TUMOR PAIN TENDERNESS	37	16	13	1	1	3
TUMOR BLOOD OR PUS IN SALIVA	0	0	1	0	0	1
TUMOR PAIN FACIAL PALSY	0	2	6	0	1	0
TUMOR ULCERATION	0	4	1	0	0	0
TUMOR FACIAL PALSY SYMPTOMS OF METASTASES	0	2	3	0	0	0

Table I

by carcinoma or sarcoma There was no instance in which a benign tumor produced facial paralysis The facial nerve withstands stretching to an enormous degree if this is accomplished gradually by a slowly expanding tumor The presenting symptoms in three patients were related to the presence of distant metastases in bone, lung or mediastinum

A benign, slowly growing tumor which exhibits suddenly an increased, unexplained growth rate usually is considered to have undergone malignant change That this is not always true is apparent in the significant proportion of patients with mixed tumors who indicated their awareness of recent rapid growth The incidence of this change in growth rate is much greater in patients with malignant lesions, but its presence

GROWTH RATE

	RECENTLY INCREASED GROWTH	SLOW GROWTH
MIXED TUMORS	17	96
CARCINOMA IN MIXED TUMORS	14	40
CARCINOMA	13	28
SARCOMA IN MIXED TUMORS	1	6
SARCOMA	1	1
PAPILLIFEROUS CYSTADENOMA LYMPHOMATOSUM	0	10

Table II

alone did not invariably indicate malignant change (see Table II) The reliability of the patient's observation on rate of growth is frequently faulty and weighs further against the usefulness of this finding A change in growth rate with infiltration into adjacent gland or fixation of the more rapidly growing tumor to skin or underlying structures is of more important significance, however, one-third of the patients in this series had had from one to four operations before their admission to this hospital, while another less large group had received some form of irradiation therapy over their tumor, even when benign, thus diminishing considerably the value of any observation on the degree of fixation

The differentiation between benign and malignant tumors cannot be made on the basis of the duration of symptoms (see Table III) Likewise, little additional help is obtained from the size of these tumors (see Table IV) since many of the largest tumors were malignant and had been present for many years

DURATION OF SYMPTOMS
(ONSET TO FIRST ADMISSION)

	0–1 MO	1–3 MO	3–6 MO	6–12 MO	1–2 YRS	2–3 YRS	3–4 YRS	4–5 YRS	5–6 YRS	6–7 YRS	7–8 YRS	8–9 YRS	9–10 YRS	10–15 YRS	15–20 YRS	OVER 20 YRS	UNKNOWN
MIXED TUMORS	1	2	4	8	14	10	9	10	10	1	4	1	5	8	10	7	9
CARCINOMA IN MIXED TUMORS		2	1	5	5	4	3	3	3	4	1	1	2	9	3	6	2
CARCINOMA		2	7	7	4	2	1			3		2	2	3	2	6	
SARCOMA IN MIXED TUMORS		1				3		1						2			
SARCOMA							1	1									
PAPILLIFEROUS CYS ADENOMA LYMPHOMATOSUM			1	2	1	1	2	1	2								

Table III

While the correct diagnosis of parotid gland tumors usually is not difficult, the physician must on occasion differentiate chronic inflammatory processes from tumor In practically all instances chronic suppurative processes involve the entire gland In all patients with parotid swelling, the orifice of Stenson's duct must be examined Gentle massage over the parotid gland and pressure along the course of the duct will result in a flow of fluid from the duct orifice In the presence of a chronic inflammatory process a thick mucinous fluid or pus will be obtained In rare instances (see Table I) pus or blood will be expressed from the duct when a tumor is present.

SIZE OF TUMOR ON ADMISSION

	1 CM	2 CM	3 CM.	4 CM	5 CM.	6 CM.	7 CM.	8 CM.	9 CM	10 CM	OVER 10 CM.	NOT RECORDED	REMOVED ELSEWHERE
MIXED TUMORS	9	28	37	8	11	11	2	1	0	1	0	5	0
CARCINOMA IN MIXED TUMORS	2	8	13	3	9	4	1	2	0	2	2	6	2
CARCINOMA	3	4	6	4	6	3	1	2	1	1	0	9	1
SARCOMA IN MIXED TUMORS	0	3	1	0	0	2	0	1	0	0	0	0	0
SARCOMA	0	0	0	0	1	0	0	0	0	0	0	1	0
PAPILLIFEROUS CYSTADENOMA LYMPHOMATOSUM	0	1	3	2	3	1	0	0	0	0	0	0	0

Table IV

If the patient's history indicates considerable fluctuation in the size of the tumor and if swelling increases at meal time, an obstruction in the duct, probably a calculus, must be considered In such instances probing of the duct and radiographic studies may facilitate the diagnosis

Further differentiation must be made between hypertrophy of the masseter muscle and parotid tumors Within the past two to three years we have become increasingly aware of hypertrophy of this muscle as a clinical entity and a cause of swelling in the parotid region Four patients have been observed with such a condition simulating a parotid tumor In each instance the swelling has occurred in a young female and has been unilateral Clinical differentiation may be confirmed by the increased prominence of the mass with contraction of the masseter muscle Two of these patients have had confirmation of this diagnosis by surgical exploration Further studies on their etiology, character and pathology are in progress

The parotid gland may be the seat of a lymphoblastoma, primary here or associated with generalized manifestations of the disease In such instances bilateral parotid tumors may be encountered

Since the evidence of malignancy in a parotid tumor cannot be determined accurately by the size of the tumor, its rate or duration of growth, or by the age (see Table V) or the sex

AGE

DECADES	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH
MIXED TUMORS	8	17	28	21	18	15	6	
CARCINOMA IN MIXED TUMOR	2	6	15	9	11	5	3	3
CARCINOMA	1	4	6	7	5	11	5	2
SARCOMA IN MIXED TUMOR		4	2			1		
SARCOMA			1		1			
PAPILLIFEROUS CYSTADENOMA LYMPHOMATOSUM					3	5	2	

Table V

(see Table VI) of the patient, the treatment undertaken must be based on the premise that a malignant tumor exists If cure is to be attempted by surgical resection of any known malignant tumor it must be carried out before distant metastases have occurred The decision in favor of any form of treatment then depends upon the estimated end-result of that treatment This estimate is based primarily upon long term survival of the patient without recurrence of the tumor In

SEX

	MALE	FEMALE
MIXED TUMORS	46	67
CARCINOMA IN MIXED TUMORS	25	29
CARCINOMA	22	19
SARCOMA IN MIXED TUMORS	4	3
SARCOMA	1	1
PAPILLIFEROUS CYSTADENOMA LYMPHOMATOSUM	7	3

Table VI.

SURVIVAL*

		0-2 YRS.	2-5 YRS	5-10 YRS.	10 YRS.+	TOTAL
MIXED TUMORS	ALIVE	13	41	38	14	106
	DEAD	0 / 2	0 / 1	0 / 1	0 / 0	4
CARCINOMA IN MIXED TUMORS	ALIVE	8	12	11	8	39
	DEAD	4 / 2	1 / 0	0 / 1	1 / 2	11
CARCINOMA	ALIVE	9	3	2	3	17
	DEAD	6 / 1	1 / 0	0 / 1	0 / 0	9
SARCOMA IN MIXED TUMORS	ALIVE	0	0	2	3	5
	DEAD	1 / 0	0 / 0	0 / 0	0 / 0	1
SARCOMA	ALIVE	0	0	0	1	1
	DEAD	0 / 0	0 / 0	1 / 0	0 / 0	1
PAPILLIFEROUS CYSTADENOMA LYMPHOMATOSUM	ALIVE	1	6	1	0	8
	DEAD	0 / 0	0 / 1	0 / 0	0 / 1	2

*AFTER LAST OPERATION AT UNIVERSITY HOSPITAL

DEAD OF TUMOR / DEAD UNRELATED CAUSE

Table VII

Table VII is shown the survival of the 204 patients included in this study who had their tumors excised Nine patients were not operated upon in this hospital Fourteen patients had only a simple biopsy of their tumor mass There was one operative death from injury to the common carotid artery, in a patient with a far advanced carcinoma arising in a mixed tumor, an immediately operative mortality rate of 0 49 per cent Six patients of the carcinoma in mixed tumor group and seven patients in the primary carcinoma group have died from recurrence of their neoplasms Thus 12 per cent of those patients with carcinomas appearing in a mixed tumor and 27 per cent of those with ductal carcinomas are dead of their disease In this group of patients the majority of deaths from tumor recurrence occurred within the first two years, survival beyond the five-year period gave an excellent expectancy for a permanent cure The one patient, who died 10 years, nine months after removal of a medullary carcinoma, did so from a similar tumor in the bronchus Because of the low degree of differentiation of the bronchial neoplasm, its origin, whether from the bronchus or previously removed parotid tumor, could not be determined

The patients with sarcoma of the parotid are few, and little significance can be attached to their death rates in our series

From the foregoing table it is apparent that long survival is not unlikely after surgical removal of a malignant parotid tumor As in patients with neoplasms elsewhere, this favorable outcome is dependent upon the size and extent of the tumor when seen and the thoroughness with which its removal can be accomplished It does not seem, therefore, that continued observation until such a tumor reaches tremendous proportions may have any commendable virtue[3]

Recurrence of tumors (including all groups) after resection in this hospital has been seen in 27 patients, an overall incidence of 13 3 per cent Nine patients have returned for reoperation Five of these have had one subsequent operation after the initial one, two have had two later operations, and in two patients three subsequent resections have been done

While recurrence may result from the presence of a satellite tumor which has remained unrecognized after removal of the larger tumor, and while some of the mixed tumors may have multicentric origins, most recurrences have resulted from inadequate removal A tumor 1 to 2 cm in diameter is frequently enucleated under local anesthesia and fear of damage to a branch of the facial nerve readily leads to incomplete intracapsular removal There is little doubt that this is the reason that a higher recurrence rate is noted, particularly in the benign mixed tumors, when small lesions are removed surgically Ideally, entire visualization of the adjacent branches of the nerve should be obtained and resection of the intact tumor with a wide margin of adjacent parotid gland performed By such a method only can recurrence after operation be attributed to the presence of a tumor with multiple centers of origin

Squamous cell carcinomas arising in the parotid gland are considered highly malignant[10] Sixteen patients in this present survey had lesions of this character Five of these were treated by Roentgen therapy alone Two of them might well have been considered suitable for surgical resection at the present writing These five patients so treated survived from seven to 15 months, with an average survival of 10 months In 11 patients resection of the tumor and parotid gland was undertaken, three of the patients have been operated upon recently and must await longer evaluation Five of these 11 patients are now dead, three of them dying with recurrence of their tumors between one and two years after excision, and two dying four and one-half and nine years after operation of unrelated causes and without clinical evidence of recurrence At the time of death three of the patients with squamous cell lesions had distant metastases in spine, lung or mediastinum The three remaining patients are alive, without clinical recurrence of their tumors after adequate surgical excision, five and one-half to 14 years Thus five patients, either alive or dead without clinical reappearance of their tumors, survived four and one-half to 14 years after resection

The incidence of less well differentiated lesions in the squamous cell carcinomas is greater than in the other histologically malignant tumors Thus nine of the 16 patients with squamous cell carcinomas had Grade III or ungraded medullary lesions

In the group of 113 patients with benign mixed tumors, there have been 12 patient recurrences (10 9 per cent) Ten patients are now living who have recurrences of their mixed tumors

In the 10 patients with papilliferous cystadenoma lymphomatosum, no secondary operations have been done and no recurrences are present

In the entire group of 84 patients with malignant tumors, recurrence after resection has occurred in 15, or 17 8 per cent Two patients living from five to 15 years after resection of a carcinoma arising in a mixed tumor have recurrences

The figures presented in the survival table (see Table VII), however, do not give an entirely accurate estimate of prolonged survival in the patients with malignant disease, since approximately one-third of these patients have been operated upon within five years In this five-year period the greatest number of recurrences and deaths occur and until these individuals have survived without recurrence more than five years, their recurrence rate cannot be estimated with assurance

The customary evaluation of therapy on the basis of five-year cure is difficult in a series of this type Tabulation of such cures in the case of benign mixed tumors carries no significance since recurrences have been noted 20, 30 or more years after excision, however, in the case of malignant tumors, a tabulation of five-year survivals without recurrence seems justifiable (see Table VIII) In the 25 patients with carcinoma in mixed tumors, operated upon more than five years ago, 18, or 72 per cent, are alive or lived five years or more without recurrence of their tumors Of the 11 patients with primary carcinoma who were operated upon more than five years ago, six survived more than five years without recurrence of tumor Five of these patients are alive at this time Five of the six patients with sarcoma arising in a mixed tumor are alive without tumor recurrence more than five years after operation Only one of the two primary sarcoma patients operated upon more than five years ago is alive without recurrence

FIVE YEAR SURVIVAL AFTER EXCISION

	CARCINOMA IN MIXED TUMORS	CARCINOMA	SARCOMA IN MIXED TUMORS	SARCOMA	TOTAL
ALIVE WITHOUT RECURRENCE OF TUMOR	16 (64 %)	5 (45 %)	5 (83 %)	1 (50 %)	27 (61 3
DEAD WITHOUT RECURRENCE OF TUMOR	2 (8 %)	1	0	0	3 (6 8
Σ					68 1 %
ALIVE WITH RECURRENCE OF TUMOR	2	0	0	0	2 (4 5
DEAD FROM RECURRENCE OF TUMOR	5	5	1	1	12 (27 2 %
TOTAL PATIENTS	25	11	6	2	

Table VIII

Thus 68 1 per cent of the patients operated upon more than five years ago have survived from five to 10 years without recurrence of tumor Twenty-seven, or 61 3 per cent, of these are alive without recurrence at this time

The results described thus far are based on the premise that tumors of the parotid gland are best treated by surgical removal The plan of surgical attack has been relatively uniform The variations in method are dictated by the size, character and location of the tumor

In the surgical removal of a parotid tumor, adequate exposure of the field is of paramount importance Small, incorrectly placed incisions endanger the facial nerve and make complete excision of the tumor difficult or impossible The incision usually used begins just below the level of the zygomatic process and immediately in front of the tragus It is carried below the ear posterior to the angle of the mandible,

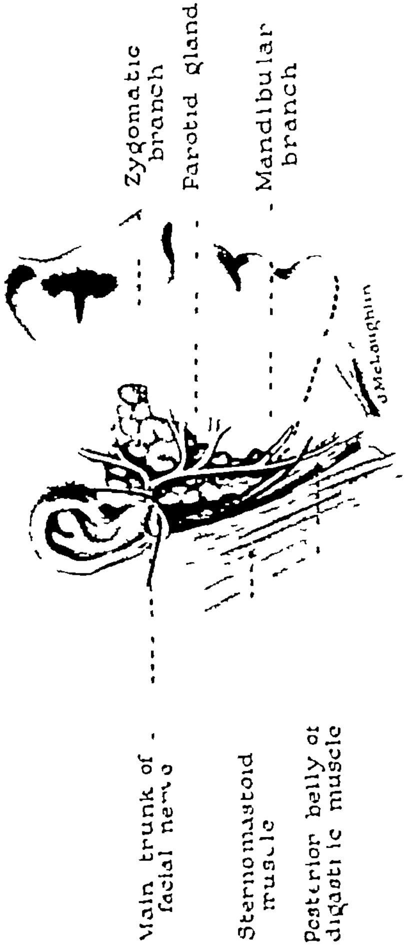


Fig 1

and beneath the lobule for 1 to 2 cm, then forward along the posterior belly of the digastric muscle The skin and subcutaneous tissues of the flap thus formed are reflected forward, exposing the surface of the parotid gland widely Although the tumor may present itself on the surface of the superficial portion of the gland thus exposed, it is usually necessary to incise normal gland tissue to expose the tumor capsule In order to safeguard any branch of the facial nerve in this area it is wise to pass the electrode of a simple faradic excitor over the surface of the gland before incising it If no contraction of the facial muscles occurs with two to three volts of faradic current the operator may be reasonably certain that incision into gland tissue at this point is safe This maneuver is of utmost importance when the tumor is attacked in the above fashion, since tumors arising in the deep or pterygoid lobe of the gland may produce atrophy of the superficial gland tissue and push the facial nerve far laterally

When the capsule of the tumor has been exposed, both the tumor and the capsule must be removed Intracapsular evacuation of a surgically exposed tumor, followed by curettage of the remaining tumor elements has no place today in the surgical treatment of parotid tumors[2] Portions of the capsule left *in situ* are often the source of recurrence since small islands of tumor tissue or epithelial ducts may be demonstrated in microscopic sections of the connective tissue capsule Considerable effort should be made to prevent rupture of the tumor Occasionally recurrent mixed tumor nodules are found in the subcutaneous scar, indicating that seeding of the tumor at the time of the original excision had occurred The ease with which mixed tumors of the parotid gland are grown in tissue cultures seems to favor this hypothesis[11] When soiling of the wound by spilled tumor contents occurs, vigorous mechanical cleansing by prolonged irrigation should be done

Tumors in the superficial portion of the gland may lie on the facial nerve or its branches As the tumor is elevated from its bed, "tenting" of the nerve may result Care must be taken in freeing the mesial portion of the tumor lest a segment of the nerve be excised

Tumors lying in the deeper portions of the parotid gland, mesial to or beneath the facial nerve, demand exacting technique in their removal In such instances the operation

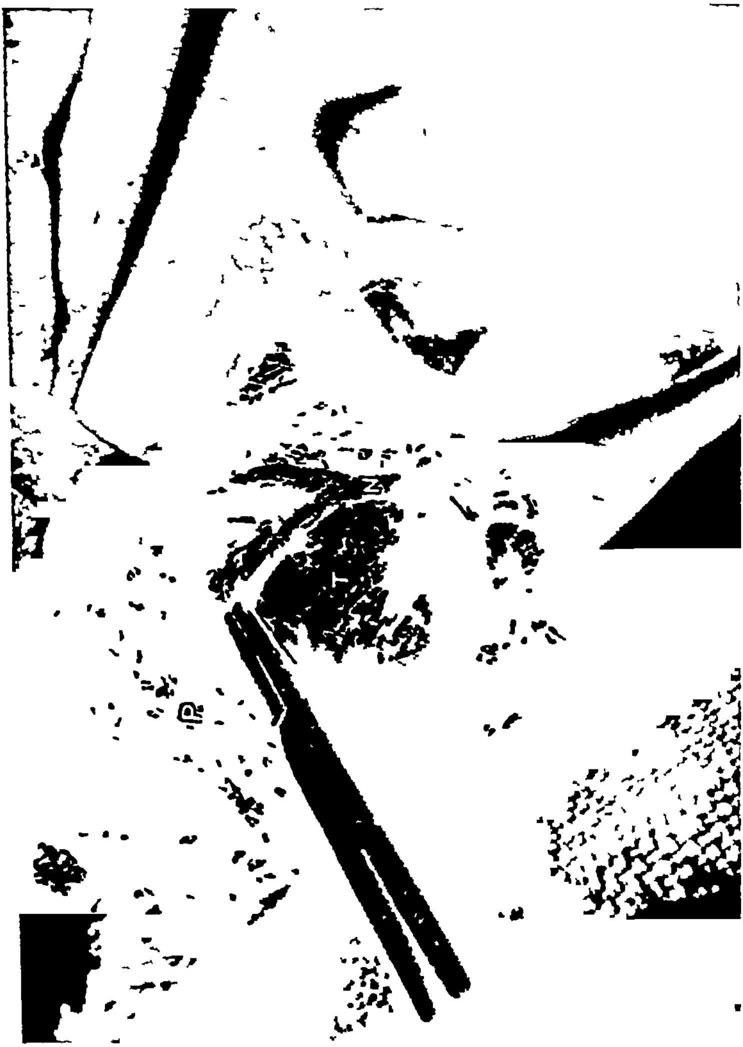


Fig 2 Facial nerve (N) pes anserinus and the temporofacial and cervicofacial divisions greatly stretched over a deeply lying tumor (T) Residual parotid gland (P) lies anterior and superficial to the more distal nerve branchings

becomes an anatomical dissection of the facial nerve and its branches with incidental removal of the tumor or perhaps the entire parotid gland If the facial nerve has been stretched gradually by the expanding tumor, it will withstand considerably more surgical trauma than normally

If the tumor is very large, its removal may be facilitated

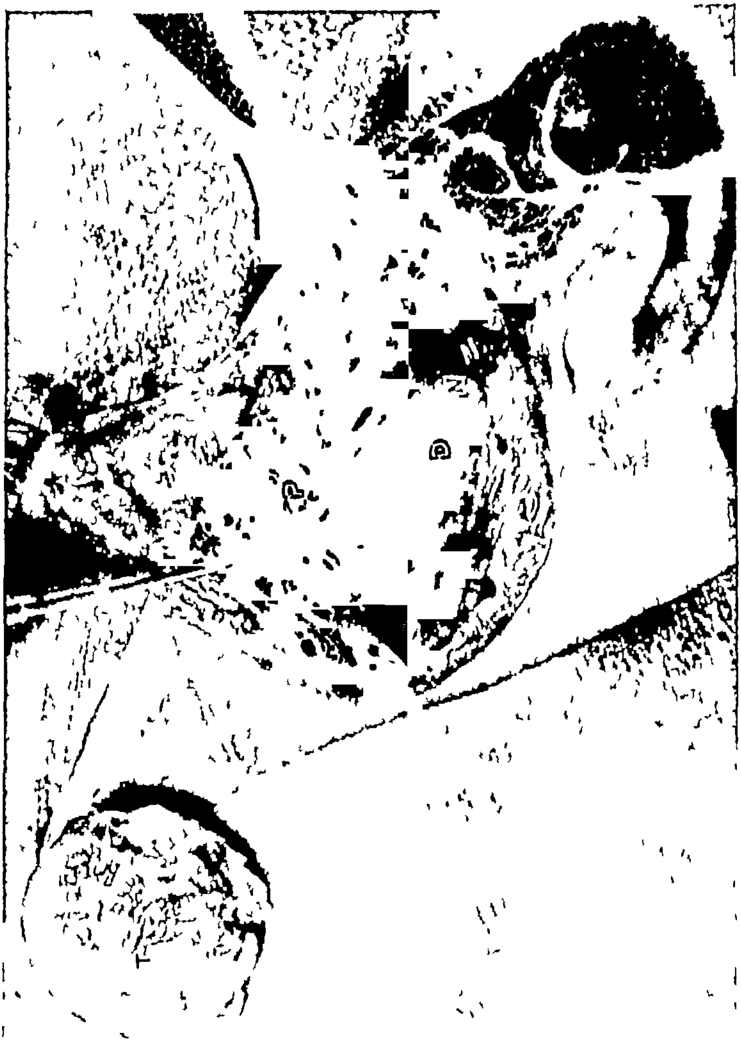


Fig 3 Tumor (T) has been removed leaving large defect (D) below the facial nerve (N) which has assumed its normal position

by opening the capsule and removing a portion of its contents This will permit removal of the entire capsule even if it has invaded the lateral pharyngeal space

Since tumors of large size often distort the normal course

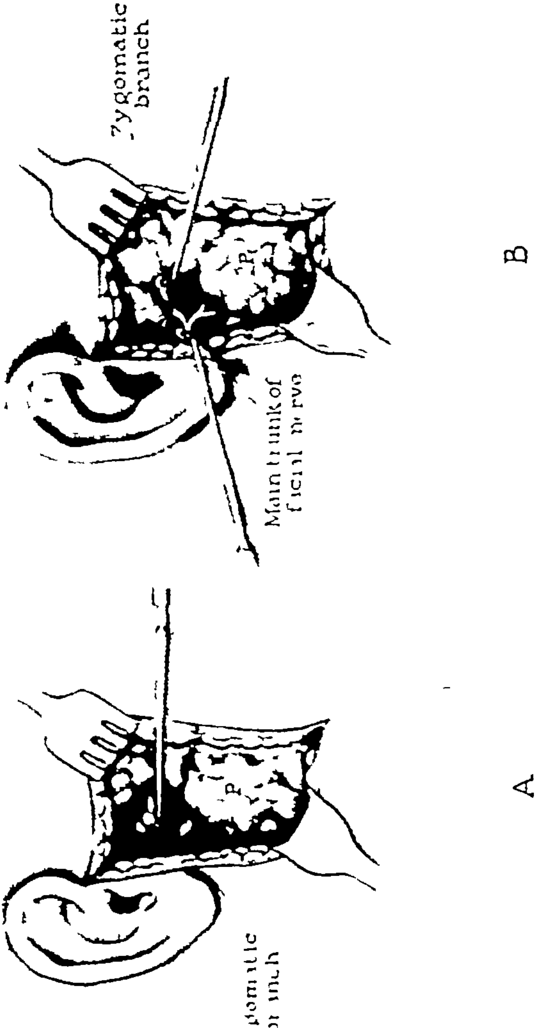


Fig 1 Technique I for identification of facial nerve at operation (A) Zygomatic branch of temporofacial division of the facial nerve exposed through incision in parotid gland (P) parallel to lower border of zygomatic arch (B) Proximal exposure of zygomatic branch pes anserinus and main facial trunk

of the facial nerve, the surgical approach to such a tumor may be facilitated by preliminary exposure of the nerve The initial exposure of the facial nerve may be accomplished in various ways

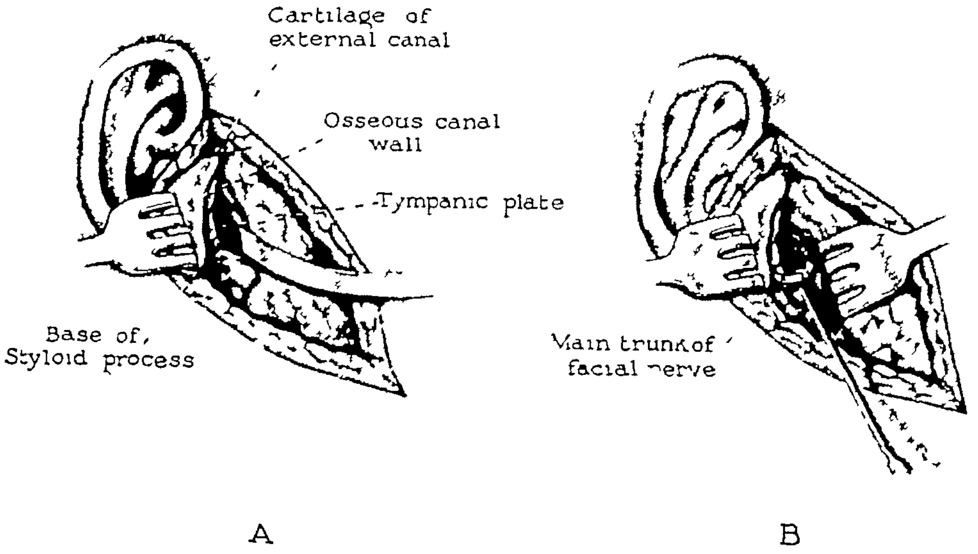


Fig 1 Technique IV for identification of facial nerve (A) Parotid gland separated from cartilage of external ear and osseous canal wall Tympanic plate and base of styloid process exposed (B) Main trunk of facial nerve identified as it crosses base of styloid process

1 After reflecting the skin flap, the zygomatic branch of he nerve which lies inferior and parallel to the zygomatic rch may be located beneath the surface of the gland This ranch may then be traced posteriorly to expose the pes and

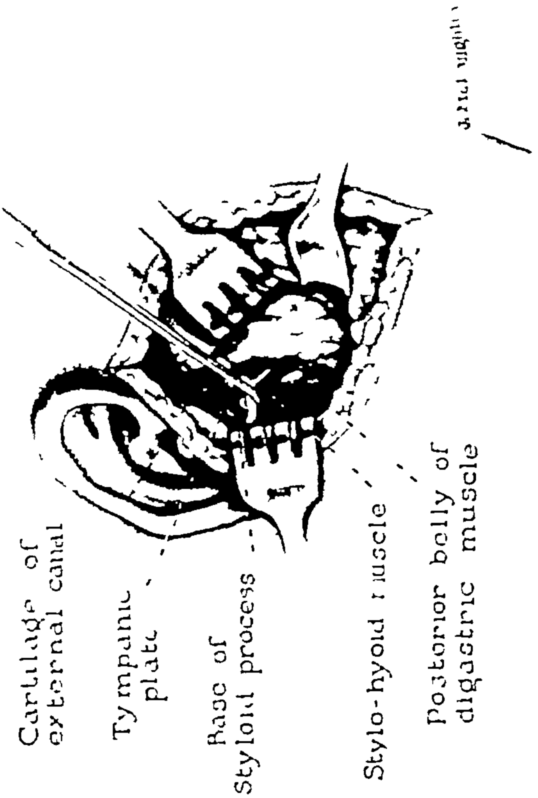


Fig 6

the main facial trunk This method of identification is best used when the tumor is large and encroaches upon the stylomastoid foramen, making identification of the nerve as it leaves the foramen hazardous

2 The mandibular branch of the nerve may be identified as it extends below the horizontal ramus of the mandible and traced proximally to the facial trunk The small size of this branch and its slightly variable position make this method less desirable

3 The mastoid tip may be removed to permit identification of the nerve at the stylomastoid foramen, from which point it may be traced distally to its bifurcation and terminal branches

4 The fourth method[13] is the one we have used most commonly the fascial sheath of the parotid gland is separated from the perichondrium of the external auditory canal Dissection is carried past the tympanic plate until the base of the styloid process is identified This dissection is relatively bloodless The trunk of the facial nerve is next identified as it passes just lateral to the base of the styloid process Frequently the region between the mastoid process and the angle of the mandible is filled by tumor and isolation of the nerve at this stage may be difficult In this instance the lower pole of the gland and the enclosed tumor may be elevated readily from the underlying posterior belly of the digastric muscle and as the dissection approaches the base of the styloid process the nerve will be encountered

When a tumor is unencapsulated and has invaded the gland widely, extirpation of the entire gland should be accomplished This is best done after the facial nerve is completely exposed and retracted Any branches of the nerve, known to be invaded by the presence of preoperative muscle palsies, or grossly infiltrated at the time of operative exposure, should be sacrificed

Inadvertently severed facial branches, or those transected deliberately to facilitate removal of a tumor, must be reap proximated accurately at the end of the operation The prognosis for return of function of the facial nerve is better when the main trunk is severed and resutured than when it is stretched to the point of severe injury in attempting to extirpate tumors of large size

Far advanced malignant tumors of the parotid gland may produce metastatic foci in the regional cervical nodes In the absence of far distant spread, radical removal of the deep cervical nodes should be carried out

The results of surgical treatment, carried out in the manner just described, are measured not only in the number of patients free from recurrence of their tumor and the length of survival of patients with malignant lesions, but also in the number and kind of complications directly related to this method of treatment In Table IX are listed these sequelae

POSTOPERATIVE COMPLICATIONS

	NO. OF PATIENTS	NO. OPERATION	BIOPS	NO. OF RESECTIONS	PERMANENT PALSY		TEMPORARY PALSY	SALIVARY FISTULA	RECURRENCE AFTER LAST OPERATION	PATIENT RECURRENCE
					PART.	COMPLETE				
MIXED TUMORS	113	3	0	16	6	2	15	6	10	12 (10.9 %)
CARCINOMA IN MIXED TUMORS	54	4	2	50	9	6	2	0	6	6 (12.5 %)
CARCINOMA	4	3	12	32	4	3	4	0	7	7 (26.9 %)
SARCOMA IN MIXED TUMORS	7	1	0	6	0	0	0	0	1	1 (16.6 %)
SARCOMA	2	0	0	4	0	0	0	0		1 (50.0 %)
PAPILLARY CYSTADENOMA LYMPHOMATOSUM	0	0	0	0	0	0	[illegible]	0	0	0
TOTAL	27	1	14	2	9		23	6	25	27 (10.3 %)

5 SACRIFICED DELIBERATELY
7 SACRIFICED DELIBERATELY

Table IX

The most feared complication of surgical removal of a parotid tumor or gland is facial muscle palsy from damage to the facial nerve This occurred in 53 patients In 23 of these, the palsy was temporary and return of function of the main facial trunk This method of identification is best used when the tumor is large and encroaches upon the stylomastoid foramen, making identification of the nerve as it leaves the foramen hazardous

2 The mandibular branch of the nerve may be identified as it extends below the horizontal ramus of the mandible and traced proximally to the facial trunk. The small size of this branch and its slightly variable position make this method less desirable

3 The mastoid tip may be removed to permit identification of the nerve at the stylomastoid foramen, from which point it may be traced distally to its bifurcation and terminal branches

4 The fourth method[13] is the one we have used most commonly the fascial sheath of the parotid gland is separated from the perichondrium of the external auditory canal Dissection is carried past the tympanic plate until the base of the styloid process is identified This dissection is relatively bloodless The trunk of the facial nerve is next identified as it passes just lateral to the base of the styloid process Frequently the region between the mastoid process and the angle of the mandible is filled by tumor and isolation of the nerve at this stage may be difficult In this instance the lower pole of the gland and the enclosed tumor may be elevated readily from the underlying posterior belly of the digastric muscle and as the dissection approaches the base of the styloid process the nerve will be encountered

When a tumor is unencapsulated and has invaded the gland widely, extirpation of the entire gland should be accomplished This is best done after the facial nerve is completely exposed and retracted Any branches of the nerve, known to be invaded by the presence of preoperative muscle palsies, or grossly infiltrated at the time of operative exposure, should be sacrificed

Inadvertently severed facial branches, or those transected deliberately to facilitate removal of a tumor, must be reap-proximated accurately at the end of the operation The prognosis for return of function of the facial nerve is better when the main trunk is severed and resutured than when it is stretched to the point of severe injury in attempting to extirpate tumors of large size

Far advanced malignant tumors of the parotid gland may produce metastatic foci in the regional cervical nodes In the absence of far distant spread, radical removal of the deep cervical nodes should be carried out

The results of surgical treatment, carried out in the manner just described, are measured not only in the number of patients free from recurrence of their tumor and the length of survival of patients with malignant lesions, but also in the number and kind of complications directly related to this method of treatment In Table IX are listed these sequelae

POSTOPERATIVE COMPLICATIONS

	TOTAL PATIENTS	NO OPERATION	BIOPSY	TOTAL RESECTIONS	PERMANENT PALSY		TEMPORARY PALSY	SALIVARY FISTULA	RECURRENCE AFTER LAST OPERATION	PATIENT RECURRENCE
					PART	COMPLETE				
MIXED TUMORS	113	3	0	116	6	2	15	6	10	12 (0 9 %)
CARCINOMA IN MIXED TUMORS	54	4	2	50	9	6	2	0	6	6 (12 5 %)
CARCINOMA	41	3	12	32	4	3	4	0	7	7 (26 9 %)
SARCOMA IN MIXED TUMORS	7	1	0	6	0	0	0	0	1	1 (16 6 %)
SARCOMA	2	0	0	4	0	0	0	0	1	1 (50 0 %)
PAPILLIFEROUS CYSTADENOMA LYMPHOMATOSUM	10	0	0	0	0	0	2	0	0	0
TOTAL	227	11	14	2 8	9	1	23	6	25	27 (13 3 %)

SACRIFICED DELIBERATELY
7 SACRIFICED DELIBERATELY

Table IX

The most feared complication of surgical removal of a parotid tumor or gland is facial muscle palsy from damage to the facial nerve This occurred in 53 patients In 23 of these, the palsy was temporary and return of function of the facial muscles usually occurred before the patients were discharged from the hospital. In 30, or 14.7 per cent, of the 204 patients whose tumors were removed, some degree of permanent palsy exists. In 17 patients voluntary sacrifice of all or a part of the nerve was necessary because of the size of the tumor or invasion of the nerve by it. Accidental or involuntary paralysis of facial muscles occurred in 6.3 per cent, or 13 patients. In only one instance did total accidental palsy occur and this undoubtedly resulted from severe stretching of the main facial trunk. The great majority of patients who now have some degree of permanent loss of facial muscle function have had injury to the mandibular nerve. Such paralyses are commonly disregarded by the patient and are noted only on examination by the physician.

Post operative salivary fistulae were noted in six patients, all with mixed tumors. All fistulae were temporary and all but two ceased spontaneously. In two patients 450 r of Roentgen therapy were administered over the parotid gland before the accumulation of salivary secretion ceased. The removal of small tumors near the anterior edge of the parotid gland may result in transection of its duct. Reimplantation into the mouth is readily accomplished if secretion is not arrested by Roentgen therapy.

The place of Roentgen therapy in the treatment of parotid tumors is still not well defined.[12] The majority of mixed tumors are but slightly radiosensitive, nevertheless, many favorable reports exist on the combined use of surgery and Roentgen therapy in these tumors. The arguments for the use of combined therapy are based on the fact that these tumors are not homogeneous and that even though the myxomatous and cartilage-like elements are insensitive to radiation, the epithelial elements may not be. Radiation, by its effect on these elements, should bring about cessation of growth. Since there is little evidence that complete destruction of a mixed tumor is obtained short of extensive damage to the adjacent normal structures, radiation has been used in none of our patients with mixed tumors, either pre- or postoperatively, except in two patients so treated because of salivary fis tulae We are unable to evaluate the effectiveness of such treatment, therefore, on the incidence of subcutaneous recurrence from tumor cells which may have escaped after rupture during surgical extirpation

The radiosensitivity of malignant parotid gland tumors is seldom marked, although Ahlbom[12] found that 16 per cent of his patients' tumors showed marked sensitivity Among his patients the pseudoadenomatous basal cell carcinomas showed good radiosensitivity, while the most resistant tumors were the adenocarcinoma and squamous cell carcinoma types

	Post-operative Roentgen Therapy	Dead	Alive	No Post-operative Therapy	Dead	Alive
Carcinoma in mixed tumors	19	4	15	29	6	23
Carcinoma	18	8	10	8	1	7
Sarcoma in mixed tumors	2	1	1	4	0	4
Sarcoma	1	0	1	1	1	0

Forty patients with malignant tumors, upon whom we carried out surgical resection of the tumor, were given Roentgen therapy postoperatively The distribution of these patients and their present survival is indicated above This is a small number of patients and the reasons for or against administration of therapy in the postoperative period cannot be correctly evaluated at this date

In general, the administration of such treatment at the present time depends upon the degree and extent of invasion of adjacent tissues by the tumor and the thoroughness with which the surgeon is able to ablate it When given at all, Roentgen ray administration is carried to the limits of tolerance of the normal tissues When complete surgical removal is accomplished, postoperative irradiation is of doubtful value This concept is particularly applicable in the patients with malignant change in a mixed tumor since these tumors frequently appear well encapsulated and thus complete removal with a surrounding layer of normal gland is readily accomplished For this reason the largest number of patients given no postoperative irradiation fall in this category On the other hand, since complete removal of the widely and irregularly infiltrating carcinomas and sarcomas is less certain, these should receive postoperative X-ray therapy Without a more accurate and detailed evaluation of the lesions treated by irradiation postoperatively than that possible at this time, we are unable to evaluate properly the usefulness or effectiveness of Roentgen therapy in primary malignant parotid tumors We are of the opinion, however, that the use of irradiation alone in the treatment of such lesions rarely is curative, and that its use, in conjunction with surgical removal, is of value only where large and vigorous dosage is administered

SUMMARY AND CONCLUSIONS

A series of 227 patients with primary tumors of the parotid gland has been recorded

Statistical study has been made of the 204 patients upon whom surgical excision of the tumors was performed between July, 1934, and January, 1949 Pathologic material was available on all patients and all have been followed to the present time

In the classification of these tumors six categories were used One hundred thirteen patients had benign mixed tumors, 10 had a papilliferous cystadenoma lymphomatosum, also a benign lesion, 95 patients had carcinoma, 54 of which appeared to arise in a previously existing benign mixed tumor, while the remaining 41 were considered to be of ductal origin since there was no histopathologic evidence of benign mixed tumor Nine patients had sarcomas One hundred twenty of the 123 patients with benign tumors had excision of their lesions Eighty-four of the 104 patients with malignant tumors had these tumors excised Fourteen patients were subjected to biopsy only and nine patients were seen in consultation after previous operations elsewhere

The duration of the tumor in this series of patients varied from one month to more than 20 years

A study of the clinical manifestations of these tumors indicates that preoperative facial paralysis and evidence of disseminated metastases are the only reliable signs of malignancy, however, many of the malignant tumors were well encapsulated and showed no evidence of local infiltration or regional spread

It was not possible in this study to confirm the commonly held opinion that in each successive recurrence of an excised benign mixed tumor, the histologic structure becomes more cellular and the characteristics more malignant Rather, the indications are that time rather than surgical trauma is the important factor in the development of malignant change in a benign mixed tumor

Pessimistic attitudes toward the prognosis of patients with parotid tumors are cited and refuted on the basis of the tabulated results of surgical excision of the tumors in this series of patients

There was one operative fatality in a patient with far advanced carcinoma who died after injury to the carotid artery

Twenty-seven patients in the entire series have had one or more recurrences after operation, an overall incidence of 13 3 per cent patient recurrences for all tumors Reoperation has been performed on nine of these patients

Of the 110 patients who had operative removal of benign mixed tumors, there have been 12 recurrences, or 10 9 per cent Fifty-seven of these patients are less than five years postoperative Tabulation of five-year cures in the case of benign mixed tumors bears little significance since recurrences have been noted 20 and 30 years after excision

In the 10 patients who had excision of a papilliferous cyst adenoma lymphomatosum no recurrences have been found

Of the 50 patients who had excision of the carcinoma arising in a mixed tumor, 25 had the operation more than five years ago Eighteen of these, or 72 per cent, survived five years or more without recurrence of tumor

All of the six patients who had operation for removal of sarcoma arising in a mixed tumor were operated upon more than five years ago Five, or 83 per cent, of these survived five or more years without recurrence of tumor

Of the 26 patients who had primary carcinomas removed, 11 had their operations more than five years ago Six, or 54 per cent, of these survived five or more years without recurrence of tumor

The two patients with primary sarcoma of the gland were operated upon more than five years ago One of these survived more than five years without recurrence of tumor

Therefore, of the 44 patients who had operations for the removal of malignant tumors of all types more than five years ago, 30, or 68 1 per cent, survived five or more years without recurrence of tumor

Twelve per cent of the entire group of patients with carcinoma arising in a mixed tumor and 27 per cent of the patients with primary carconimas are dead of their disease after surgical resection The primary carcinoma seems to be, therefore, the most malignant type of tumor encountered in this series

The technique of surgical removal is described, including various methods of identifying and isolating the facial nerve Every effort should be made to preserve the integrity of the facial nerve when it has not been invaded by neoplasm, as indicated by preoperative paralysis or gross evidence of infiltration at the time of operation

The use of Roentgen therapy in the treatment of parotid tumors is discussed This form of therapy should be used in maximum dosage after removal of poorly encapsulated tumors the extent of which is not clearly defined and when total removal is in doubt Its use alone in the primary treatment of malignant lesions of the parotid gland is rarely curative and is acceptable only when surgical removal is contraindicated

Fifty-three patients had some degree of facial palsy postoperatively In 23 instances this palsy was temporary, usually disappearing by the time the patient left the hospital In 30 patients, or 14 7 per cent of the 204 patients there was some degree of permanent paralysis due in most instances to deliberate sacrifice of that portion of the nerve involved by the neoplasm In 13 patients (6 3 per cent) there was accidental or unpremeditated permanent palsy Only one of this group has complete paralysis The vast majority of these accidental permanent palsies involve only the lower lip and are of little concern to the patient

Salivary fistulae occurred postoperatively in six patients All of these healed promptly without surgical treatment and all occurred in patients who had removal of benign mixed tumors

The results here tabulated seem to justify the conclusion that all primary tumors of the parotid gland should be removed surgically as soon as they are discovered unless there has been dissemination of metastases to distant structures

Since the prognosis for survival in patients with parotid tumors depends upon the presence and degree of malignancy and the completeness with which resection of that tumor can be accomplished and since the differentiation between benign and malignant lesions is not always apparent unless distant metastases have occurred or facial palsy is present, early operation with complete removal of the tumor is imperative

REFERENCES

1 Patey D H Treatment of Mixed Tumors of the Parotid *Brit Jour Surg*, 28 29 1940

2 Stein I, and Geschickter, C F Tumors of the Parotid Gland *Arch Surg*, 28 492 1934

3 McFarland, J The Mysterious Mixed Tumors of the Salivary Glands *Surg, Gynec and Obst*, 76 23, 1943

4 Bailey, H The Surgical Anatomy of the Parotid Gland *Brit Med Jour*, 2 245, July 31, 1948

5 Benedict, E B, and Meigs, J V Tumors of the Parotid Gland *Surg, Gynec and Obst*, 51 626, 1930

6 McFarland, J Three Hundred Mixed Tumors of the Salivary Glands of Which 69 Recurred *Surg, Gynec and Obst*, 63 457, 1936

7 Quattlebaum, F W, Dockerty, M B, and Mayo, C W Adenocarcinoma, Cylindroma Type, of the Parotid Gland *Surg, Gynec and Obst*, 82 342, 1946

8 Foote, F W, and Becker, W F Mucoepidermoid Tumors of Salivary Glands *Ann Surg*, 122 820, 1945

9 Warthin, A S Papillary Cystadenoma Lymphomatosum *Jour Cancer Research*, 13 116, 1929

10 Ackerman, L V, and del Regato, J A Cancer Diagnosis, Treatment and Prognosis St Louis The C V Mosby Co, 1947

11 Favata, B V Characteristics of Mixed Tumors of the Parotid Gland Growing in Vitro *Surg, Gynec and Obst*, 86 659, 1948

12 Ahlbom, H E Mucous and Salivary Gland Tumors *Acta Radiol* Supp 23, pp 1 452, 1935

13 Maxwell, J H Cited by Furstenberg, A C Reconstruction of the Facial Nerve *Trans Amer Laryngol, Rhinol and Otol Soc, Inc*, pp 213 214, 1944

14 Furstenburg, A C The Parotid Gland *Jour A M A*, 117 1594 1941

TRACHEAL OBSTRUCTION*†

Charles M. Norris, M.D.,
Philadelphia, Pa.

The phenomenon of partial obstruction of the trachea is encountered much less frequently than that of laryngeal or bronchial obstruction. In the individual case, however, the implications of this clinical finding are likely to be of some urgency, depending upon the rapidity with which the obstructive dyspnea increases. Obstruction occurring as a result of trauma or the inhalation of certain types of vegetal foreign body may be rapidly fatal unless emergency treatment is available. Cases in which the onset of symptoms is less abrupt require early and accurate diagnosis, so that the occurrence of dangerous degrees of respiratory embarrassment may be averted.

Anatomically, the trachea provides a cross-section area about four times that required for quiet breathing. That this is true, at least in the adult, may be proven by the simple experiment of breathing through a length of tubing 10 to 12 cm. in length whose internal diameter, 6 to 7 mm., is approximately half that of the average adult trachea during expiration. As a matter of fact, the resistance to air flow through a normal adult trachea is estimated to be about one-sixteenth that offered by such a length of tubing, in accordance with Poiseuille's Law, which states that the resistance to flow of gases through tubular structures varies inversely with the

---

*Presented as Candidate's Thesis to American Laryngological, Rhinological and Otological Society, Inc., 19[illegible]

†From the Department of Laryngology and Broncho-Esophagology (Chevalier Jackson Clinic), Temple University Hospital and School of Medicine.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication May [illegible]

3 McFarland, J The Mysterious Mixed Tumors of the Salivary Glands *Surg, Gynec and Obst*, 76 23, 1943

4 Bailey, H The Surgical Anatomy of the Parotid Gland *Brit Med Jour*, 2 245, July 31, 1948

5 Benedict, E B, and Meigs, J V Tumors of the Parotid Gland. *Surg, Gynec and Obst*, 51 626, 1930

6 McFarland, J Three Hundred Mixed Tumors of the Salivary Glands of Which 69 Recurred *Surg, Gynec and Obst*, 63 457, 1936

7 Quattlebaum, F W Dockerty, M B, and Mayo, C W Adenocarcinoma, Cylindroma Type, of the Parotid Gland *Surg, Gynec and Obst*, 82 342, 1946

8 Foote, F W, and Becker, W F Mucoepidermoid Tumors of Salivary Glands *Ann Surg*, 122 820 1945

9 Warthin, A S Papillary Cystadenoma Lymphomatosum *Jour Cancer Research*, 13 116 1929

10 Ackerman, L V, and del Recato, J A Cancer Diagnosis, Treatment and Prognosis St Louis The C V Mosby Co, 1947

11 Favata, B V Characteristics of Mixed Tumors of the Parotid Gland Growing in Vitro *Surg, Gynec and Obst*, 86 659, 1948

12 Ahlbom, H E Mucous and Salivary Gland Tumors *Acta Radiol* Supp 23, pp 1 452, 1935

13 Maxwell, J H Cited by Furstenberg, A C Reconstruction of the Facial Nerve *Trans Amer Laryngol, Rhinol and Otol Soc, Inc* pp 213 214, 1944

14 Furstenburg, A C The Parotid Gland *Jour A M A*, 117 1594 1941

TRACHEAL OBSTRUCTION *†

CHARLES M. NORRIS, M.D.,
Philadelphia, Pa.

The phenomenon of partial obstruction of the trachea is encountered much less frequently than that of laryngeal or bronchial obstruction. In the individual case, however, the implications of this clinical finding are likely to be of some urgency, depending upon the rapidity with which the obstructive dyspnea increases. Obstruction occurring as a result of trauma or the inhalation of certain types of vegetal foreign body may be rapidly fatal unless emergency treatment is available. Cases in which the onset of symptoms is less abrupt require early and accurate diagnosis, so that the occurrence of dangerous degrees of respiratory embarrassment may be averted.

Anatomically, the trachea provides a cross-section area about four times that required for quiet breathing. That this is true, at least in the adult, may be proven by the simple experiment of breathing through a length of tubing, 10 to 12 cm. in length, whose internal diameter, 6 to 7 mm., is approximately half that of the average adult trachea during expiration. As a matter of fact, the resistance to air flow through a normal adult trachea is estimated to be about one-sixteenth that offered by such a length of tubing, in accordance with Poiseuille's Law, which states that the resistance to flow of gases through tubular structures varies inversely with the

---

*Presented as Candidate's Thesis to American Laryngological, Rhinological and Otological Society, Inc., 1949.

†From the Department of Laryngology and Broncho-Esophagology (Chevalier Jackson Clinic), Temple University Hospital and School of Medicine.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication May 18, 1949.

fourth power of the internal diameters, other factors being equal Air exchange during maximum effort has been estimated as from five to 12 times that of quiet breathing

According to Jackson, the movements of the trachea may be classified as respiratory, pulsatory, bechic and deglutitory Physiologically, the inspiratory widening and expiratory narrowing of the trachea is of great importance in explaining the expiratory character of many types of tracheal dyspnea The expiratory narrowing, easily observed bronchoscopically, and manifested by a forward mounding of the posterior or membranous portion of the tracheal wall, is most pronounced in the intrathoracic portion of the trachea, and appears strikingly in conditions associated with a high positive expiratory intrathoracic pressure, such as bronchial asthma or diffuse pulmonary emphysema

Symptomatology In general, partial tracheal obstruction is characterized by expiratory wheezing and dyspnea The distinctive character of the wheeze heard at the open mouth is such that Jackson[11] many years ago described the "asthmatoid wheeze" as pathognomonic of partial obstruction of the trachea or a large bronchus, the sign has been of particular value in foreign body diagnosis The wheeze is best heard near the end of a forced expiration, in the lesser degrees of obstruction, wheezing may be observed by the patient only during vigorous physical activity Dyspnea is evident as the degree of obstruction increases, and the wheeze may become audible during both phases of respiration Other symptoms associated with partial tracheal obstruction are described below in discussing the various disease entities

Diagnosis As has been inferred, the distinctive character of the wheeze, if present, is diagnostic, the nature of the obstruction, however, must be determined In eliciting the history, the possibility of foreign body should be investigated by specific questioning If the patient is an infant or young child, the relation between time of birth and onset of symptoms is usually significant The presence of hoarseness, difficulty in swallowing or "choking attacks" should be noted, and

inquiry should be made as to such associated symptoms as hemoptysis, chronic cough, expectoration, etc Information regarding previous illnesses and a "systemic review" to elicit symptoms referable to other systems is in order

The physical examination, in addition to careful observation of the character of any wheeze or dyspnea, and its relation to phase of respiration, should include mirror laryngoscopy, of particular importance in the external examination are the presence of enlarged cervical nodes, localized or diffuse enlargement of the thyroid gland, tracheal deviation or "tracheal tug" and venous distention

Careful Roentgen examination of the neck and chest (including fluoroscopy and a study of the "swallowing function" with opaque mixture), followed by direct laryngoscopy and tracheoscopy, will then confirm or disprove the presence of tracheal obstruction and in most cases establish the etiology

"Tracheal Stridor" in Infancy and Childhood Noisy breathin infancy and childhood may be a manifestation of obstruction anywhere from the external nares to the smaller bronchi The "stridor" of *congenital tracheomalacia* a term implying a deficiency in the support provided by the cartilaginous rings of the trachea, in many instances is of a stertorous character, the expiratory sound resembling that of snoring respirations A similar sound may be produced by blowing gently through thin-walled Penrose rubber tubing There is some evidence that increase in the normal expiratory angulation of the infant cervical trachea may be an additional factor in such cases, in several instances the appearance of suprasternal bulging, synchronous with expiration, has suggested that undue laxity of the supporting tissues at the thoracic inlet may allow increased upward displacement of the upper mediastinal structures with the positive intrathoracic pressure of expiration thus contributing to the "kinking" effect

Thymic compression of the trachea, once thought to be of common occurrence is now regarded as comparatively infrequent The classic description of the Roentgen findings in this

fourth power of the internal diameters, other factors being equal Air exchange during maximum effort has been estimated as from five to 12 times that of quiet breathing

According to Jackson, the movements of the trachea may be classified as respiratory, pulsatory, bechic and deglutitory Physiologically, the inspiratory widening and expiratory narrowing of the trachea is of great importance in explaining the expiratory character of many types of tracheal dyspnea The expiratory narrowing, easily observed bronchoscopically, and manifested by a forward mounding of the posterior or membranous portion of the tracheal wall, is most pronounced in the intrathoracic portion of the trachea, and appears strikingly in conditions associated with a high positive expiratory intrathoracic pressure, such as bronchial asthma or diffuse pulmonary emphysema

Symptomatology In general, partial tracheal obstruction is characterized by expiratory wheezing and dyspnea The distinctive character of the wheeze heard at the open mouth is such that Jackson[14] many years ago described the "asthmatoid wheeze" as pathognomonic of partial obstruction of the trachea or a large bronchus, the sign has been of particular value in foreign body diagnosis The wheeze is best heard near the end of a forced expiration, in the lesser degrees of obstruction, wheezing may be observed by the patient only during vigorous physical activity Dyspnea is evident as the degree of obstruction increases, and the wheeze may become audible during both phases of respiration Other symptoms associated with partial tracheal obstruction are described below in discussing the various disease entities

Diagnosis As has been inferred, the distinctive character of the wheeze, if present, is diagnostic, the nature of the obstruction, however, must be determined In eliciting the history, the possibility of foreign body should be investigated by specific questioning If the patient is an infant or young child, the relation between time of birth and onset of symptoms is usually significant The presence of hoarseness, difficulty in swallowing or "choking attacks" should be noted, and

inquiry should be made as to such associated symptoms as hemoptysis, chronic cough, expectoration, etc. Information regarding previous illnesses and a "systemic review" to elicit symptoms referable to other systems is in order.

The physical examination, in addition to careful observation of the character of any wheeze or dyspnea and its relation to phase of respiration, should include mirror laryngoscopy. Of particular importance in the external examination are the presence of enlarged cervical nodes, localized or diffuse enlargement of the thyroid gland, tracheal deviation or "tracheal tug" and venous distention.

Careful Roentgen examination of the neck and chest (including fluoroscopy and a study of the "swallowing function" with opaque mixture), followed by direct laryngoscopy and tracheoscopy, will then confirm or disprove the presence of tracheal obstruction and in most cases establish the etiology.

Tracheal Stridor" in Infancy and Childhood. Noisy breathing in infancy and childhood may be a manifestation of obstruction anywhere from the external nares to the smaller bronchi. The "stridor" of *congenital tracheomalacia*, a term implying a deficiency in the support provided by the cartilaginous rings of the trachea, in many instances is of a stertorous character, the expiratory sound resembling that of snoring respirations. A similar sound may be produced by blowing gently through thin-walled Penrose rubber tubing. There is some evidence that increase in the normal expiratory angulation of the infant cervical trachea may be an additional factor in such cases; in several instances the appearance of suprasternal bulging, synchronous with expiration, has suggested that undue laxity of the supporting tissues at the thoracic inlet may allow increased upward displacement of the upper mediastinal structures with the positive intrathoracic pressure of expiration, thus contributing to the "kinking" effect.

Thymic compression of the trachea, once thought to be of common occurrence, is now regarded as comparatively infrequent. The classic description of the Roentgen findings in this

fourth power of the internal diameters, other factors being equal Air exchange during maximum effort has been estimated as from five to 12 times that of quiet breathing

According to Jackson, the movements of the trachea may be classified as respiratory, pulsatory, bechic and deglutitory Physiologically, the inspiratory widening and expiratory narrowing of the trachea is of great importance in explaining the expiratory character of many types of tracheal dyspnea The expiratory narrowing, easily observed bronchoscopically, and manifested by a forward mounding of the posterior or membranous portion of the tracheal wall, is most pronounced in the intrathoracic portion of the trachea, and appears strikingly in conditions associated with a high positive expiratory intrathoracic pressure, such as bronchial asthma or diffuse pulmonary emphysema

Symptomatology In general, partial tracheal obstruction is characterized by expiratory wheezing and dyspnea The distinctive character of the wheeze heard at the open mouth is such that Jackson[14] many years ago described the "asthmatoid wheeze" as pathognomonic of partial obstruction of the trachea or a large bronchus, the sign has been of particular value in foreign body diagnosis The wheeze is best heard near the end of a forced expiration, in the lesser degrees of obstruction, wheezing may be observed by the patient only during vigorous physical activity Dyspnea is evident as the degree of obstruction increases, and the wheeze may become audible during both phases of respiration Other symptoms associated with partial tracheal obstruction are described below in discussing the various disease entities

Diagnosis As has been inferred, the distinctive character of the wheeze, if present, is diagnostic, the nature of the obstruction, however, must be determined In eliciting the history, the possibility of foreign body should be investigated by specific questioning If the patient is an infant or young child, the relation between time of birth and onset of symptoms is usually significant The presence of hoarseness, difficulty in swallowing or "choking attacks" should be noted, and

inquiry should be made as to such associated symptoms as hemoptysis, chronic cough, expectoration, etc Information regarding previous illnesses and a "systemic review" to elicit symptoms referable to other systems is in order

The physical examination, in addition to careful observation of the character of any wheeze or dyspnea, and its relation to phase of respiration, should include mirror laryngoscopy, of particular importance in the external examination are the presence of enlarged cervical nodes, localized or diffuse enlargement of the thyroid gland, tracheal deviation or "tracheal tug" and venous distention

Careful Roentgen examination of the neck and chest (including fluoroscopy and a study of the "swallowing function" with opaque mixture), followed by direct laryngoscopy and tracheoscopy, will then confirm or disprove the presence of tracheal obstruction and in most cases establish the etiology

"Tracheal Stridor" in Infancy and Childhood Noisy breathin infancy and childhood may be a manifestation of obstruction anywhere from the external nares to the smaller bronchi The "stridor" of *congenital tracheomalacia,* a term implying a deficiency in the support provided by the cartilaginous rings of the trachea, in many instances is of a stertorous character, the expiratory sound resembling that of snoring respirations A similar sound may be produced by blowing gently through thin-walled Penrose rubber tubing There is some evidence that increase in the normal expiratory angulation of the infant cervical trachea may be an additional factor in such cases, in several instances, the appearance of suprasternal bulging, synchronous with expiration, has suggested that undue laxity of the supporting tissues at the thoracic inlet may allow increased upward displacement of the upper mediastinal structures with the positive intrathoracic pressure of expiration, thus contributing to the "kinking" effect

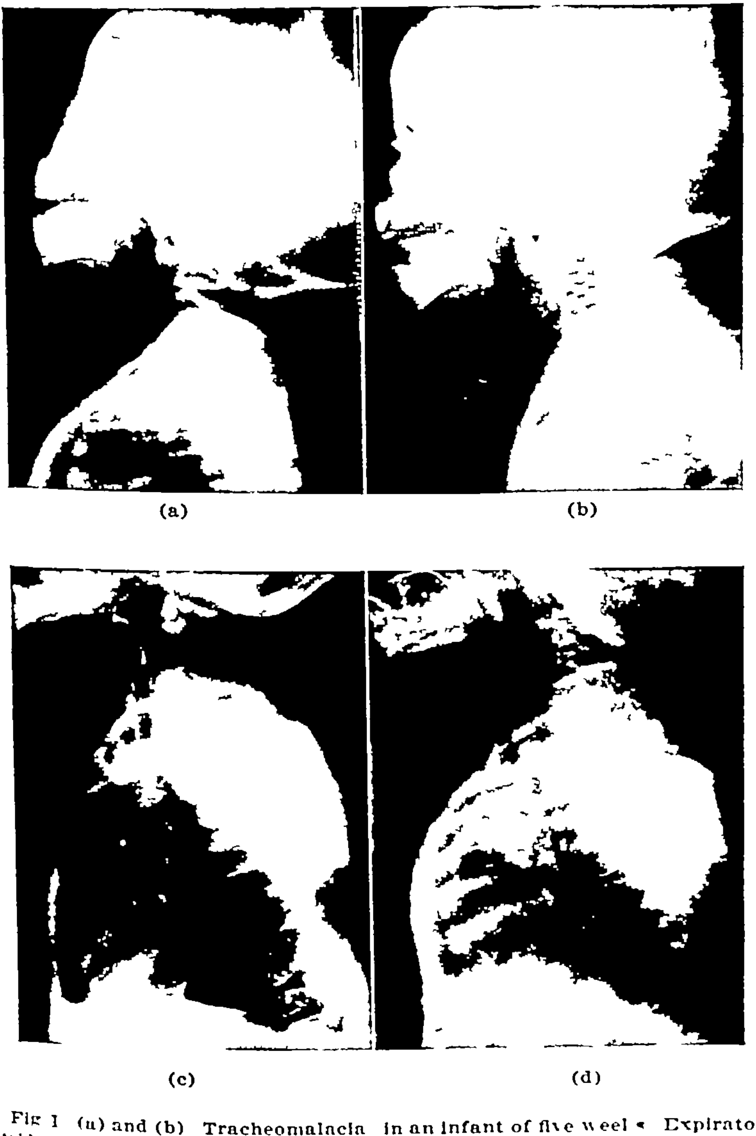
Thymic compression of the trachea once thought to be of common occurrence, is now regarded as comparatively infrequent The classic description of the Roentgen findings in this condition is that of Pancoast[30] The expiratory sound is a true wheeze comparable to that heard in other types of tracheal compression

In both of the above conditions, the symptoms are likely to date from birth or shortly thereafter, and the noisy breathing is accentuated by activity and by feeding Unlike congenital laryngeal stridor, however, the respirations during sleep are usually quiet or nearly so, and indrawing of the supra- and infrasternal spaces is less prominent Roentgen films made during expiration [see Fig I (b) and (d)] will show, in both conditions, narrowing of the tracheal lumen, however, in tracheomalacia, the inspiration film shows a tracheal lumen which is straight and of normal calibre [see Fig I (a)], in true thymic compression, the lumen of the trachea remains narrow even on full inspiration [see Fig I (c)] and is displaced dorsally

In tracheomalacia, the tracheoscopic picture is one of tracheal expiratory collapse, with reopening to normal calibre on inspiration In thymic compression, the narrowing persists in some degree during inspiration, though increased during expiration If the bronchoscope is introduced to the carinal level, the expiratory wheeze is no longer evident, as it is withdrawn a short distance, the wheeze will reappear The direct laryngoscopic findings allow a differentiation of these two conditions from laryngomalacia (congenital laryngeal stridor) in which the stridor is nearly always in the inspiratory phase

The noisy breathing of tracheomalacia is "outgrown" in a few months, or at most two years In thymic compression, small doses of Roentgen irradiation accomplish regression, and such treatment is indicated once the diagnosis is established or strongly suspected

A number of recent papers[12 26 30] have called attention to *anomalous vascular ring* as a cause of partial tracheal and esophageal obstruction in childhood These anomalies, which occur through persistence of embryonal arches other than those involved in the formation of the normally situated



(a) (b)

(c) (d)

Fig. 1. (a) and (b) Tracheomalacia in an infant of five weeks. Expiratory stridor since birth. (a) Inspiration film showing tracheal lumen of normal calibre throughout. (b) Expiration film showing marked narrowing of intrathoracic portion of trachea. (c) and (d) Thymic compression of trachea in an infant of three months. Expiratory wheezing since shortly after birth. (c) The thoracic portion of the trachea is compressed and displaced backward even in the inspiration film. (d) Narrowing and displacement are increased during expiration.

mature arteries, are, according to Gross[12] of two general types. In one type (right aortic arch, posterior type), the arch, instead of passing from right to left anterior to the trachea, passes from right to left behind the esophagus; constriction of both esophagus and trachea may occur when the pulmonary artery, lying anterior to the trachea, is joined to the distal portion of the arch by a patent ductus arteriosus or ligamentum arteriosum lying to the left of the trachea. The second type is a double aortic arch, the two limbs of the split aorta encircling both trachea and esophagus and reuniting in the left posterior mediastinum. Numerous variations of these types have been described.

The symptoms are wheezing and dyspnea of varying degree (increased during activity and decreased during sleep), and dysphagia or regurgitation, often first noted when an attempt is made to give solid or semisolid foods. The characteristic Roentgen findings (see Fig. 11) are clearly summarized by Neuhauser,[28] most suggestive is the finding of a rounded indentation of the posterior wall of the barium-filled esophagus, compression of the trachea may be observed in both projections. A definite diagnosis may be established in nearly all of these cases if Roentgen examination of the esophagus with barium mixture is made a part of the routine study in cases of stridor in infancy and childhood.

Since the tracheal obstruction is at a low level, tracheotomy is not an appropriate palliative procedure for relief of dyspnea, although introduction of a bronchoscope to the carinal level will temporarily provide an adequate airway. Persistent or recurring dyspnea constitutes an indication for thoracotomy, with ligation and division of the anomalous structures responsible for the compression.

The incidence of *tracheal foreign body* is considerably less than that of foreign body in the bronchus. In the author's series of 250 consecutive foreign bodies in the air and food passages,[18] for example, only seven, or 2.8 per cent, were in the trachea, as compared to 46, or 18.4 per cent, in the bronchus. In this group of cases all of the patients were children, the youngest 11 months and the oldest five years.

Fig 11 Compression of trachea and esophagus by 'vascular ring.' Four-year old girl with history of dyspnea, wheezing and regurgitation first noted at age of about 10 months Particularly characteristic is the posterior filling defect in the barium filled esophagus The anomaly here is presumably a right aortic arch posterior type

mature arteries, are, according to Gross[12] of two general types In one type (right aortic arch, posterior type), the arch, instead of passing from right to left anterior to the trachea, passes from right to left behind the esophagus, constriction of both esophagus and trachea may occur when the pulmonary artery, lying anterior to the trachea, is joined to the distal portion of the arch by a patent ductus arteriosus or ligamentum arteriosum lying to the left of the trachea The second type is a double aortic arch, the two limbs of the split aorta encircling both trachea and esophagus and reuniting in the left posterior mediastinum Numerous variations of these types have been described

The symptoms are wheezing and dyspnea of varying degree (increased during activity and decreased during sleep), and dysphagia or regurgitation, often first noted when an attempt is made to give solid or semisolid foods The characteristic Roentgen findings (see Fig II) are clearly summarized by Neuhauser,[26] most suggestive is the finding of a rounded indentation of the posterior wall of the barium-filled esophagus, compression of the trachea may be observed in both projections A definite diagnosis may be established in nearly all of these cases if Roentgen examination of the esophagus with barium mixture is made a part of the routine study in cases of stridor in infancy and childhood

Since the tracheal obstruction is at a low level, tracheotomy is not an appropriate palliative procedure for relief of dyspnea, although introduction of a bronchoscope to the carinal level will temporarily provide an adequate airway Persistent or recurring dyspnea constitutes an indication for thoracotomy, with ligation and division of the anomalous structures responsible for the compression

The incidence of *tracheal foreign body* is considerably less than that of foreign body in the bronchus In the author's series of 250 consecutive foreign bodies in the air and food passages,[28] for example, only seven, or 2 8 per cent, were in the trachea, as compared to 46, or 18 4 per cent, in the bronchus In this group of cases all of the patients were children, the youngest 11 months and the oldest five years

Fig 11 Compression of trachea and esophagus by 'vascular ring' Four-year old girl with history of dyspnea wheezing and regurgitation first noted at age of about 10 months Particularly characteristic is the posterior filling defect in the barium filled esophagus The anomaly here is presumably a 'right aortic arch posterior type'

A foreign body small enough to pass through the subglottic lumen would not be expected, initially, to obstruct the tracheal lumen to a dangerous degree, unless of unusual shape or consistency, however, it is generally recognized that foreign bodies capable of increasing in size with absorption of moisture (particularly the bean) may give rise to rapidly increasing dyspnea and possibly asphyxia

The initial episode of choking, coughing, wheezing and dyspnea may be followed by an asymptomatic interval More commonly, however, there is a persistent "asthmatoid wheeze" As pointed out by Jackson, foreign bodies freely movable in the trachea may give rise to severe paroxysms of cough, on cough, the "audible slap" and "palpable thud" due to sudden arrest of the foreign body at the subglottic level may be observed

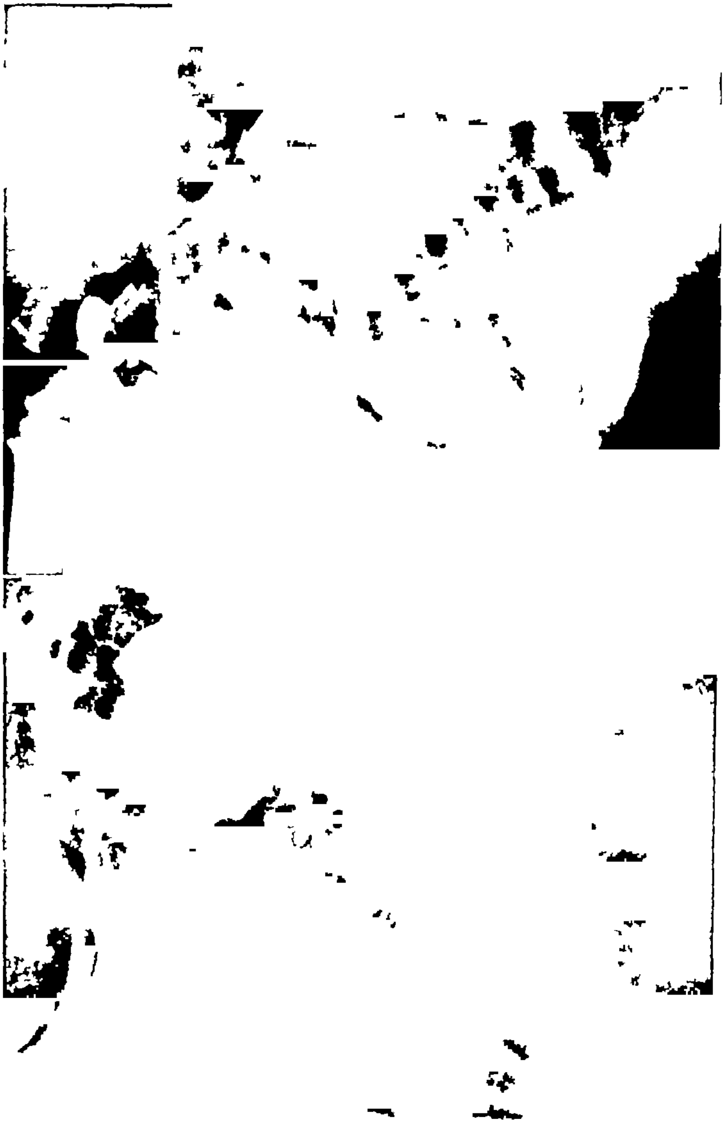
During cough, impaction in the subglottic region may occur, this event is attended by an abrupt onset of laryngeal dyspnea with inspiratory-expiratory stridor and marked supra- and infrasternal retraction, so that asphyxia appears imminent In the case of a three-year-old boy recently observed, no foreign body history could be elicited, the symptoms were those of "head and chest cold" of three days' duration When first seen in the emergency ward, the dyspnea, two-way stridor and retraction suggested acute laryngotracheobronchitis as the most likely diagnosis, but as the bronchoscope was introduced preliminary to tracheotomy, an irregular fragment of peanut was encountered at the subglottic level, this was removed and tracheotomy was not required

The Roentgen findings in tracheal foreign body may be those of bilateral obstructive emphysema, but in a rather high percentage of cases, even careful fluoroscopic study may fail to show restricted motion of the leaves of the diaphragm or impairment of emptying of the lungs Such was true in the case of a two and one-half year old boy whose wheeze, present for 18 months before his first visit to the bronchoscopic clinic, had occasional X-ray therapy for a supposedly enlarged thymus, tonsillectomy and allergic study under an erroneous diagnosis of bronchial asthma The wheeze disappeared completely with bronchoscopic removal of a wooden bead from the trachea

Tracheal wheeze and dyspnea may occur as a result of compression of the thin "party wall" between the trachea and esophagus by foreign body lodged in the upper esophagus [see Fig III (a)] If opaque, the lateral Roentgenogram will show its true location If nonopaque the presence of wheezing may appear to call for bronchoscopy unless the presence of esophageal foreign body has been demonstrated by careful Roentgen study with barium mixture

Endogenous foreign body is a common cause of tracheal obstruction in the acute tracheobronchial infections of childhood Rapidly increasing dyspnea may occur in the presence of diphtheritic exudate or the thick partially crusted secretions characteristic of acute laryngotracheobronchitis As emphasized by Jackson[18] and others, the formation of crusts following tracheotomy may usually be prevented by proper humidification of the inspired air and frequent catheter aspiration through the tracheal cannula, with preliminary instillation of a few drops of physiological saline 1 per cent sodium bicarbonate solution or a solution of penicillin in saline (5 000 u/ cc.) The persistence following thorough aspiration of wheezing, dyspnea or impaired aeration as determined by auscultation, suggests the presence of residual crusted material, and bronchoscopic removal may be required Similar problems may arise in instances of acute infection following tracheotomy for other conditions and following laryngectomy

Chronic Granulomata In tuberculosis lesions of the trachea are less frequent than those of the larynx and bronchi More often than not, the tracheal lesion represents proximal extension of one initially involving the bronchi The stages of the disease are the same as those of tuberculous bronchitis[4] (submucous infiltration ulceration or ulcerogranuloma, cicatricial stenosis) but tracheal obstruction due to granuloma is uncommon and cicatricial stenosis is much less



(a) (b)

Fig III (a) Compression of trachea by foreign body (toy jackstone) in upper esophagus of a child of two years (b) Tracheal compression due to periesophageal cellulitis Infant of six months with cough unexplained wheezing and dyspnea of three weeks duration Esophagoscopy showed a slender fragment of pearl button in the cervical esophagus Resolution following removal of the foreign body external drainage not required

common than in the bronchus, presumably because of the infrequency with which a large portion of the circumference of the tracheal wall is involved in the ulcerative stage Sweany and Behm[16] observed tracheal involvement in only 10 3 per cent of 377 cases of tuberculous tracheobronchitis. In a study of 22 cases in which perforation of a tuberculous lymph node had occurred, Auerbach[1] found six instances of perforation into the trachea.

The diagnosis of active tuberculous tracheitis is suggested by the tracheoscopic appearance of superficial ulceration, with or without granuloma, and the concomitant finding of Roentgen evidence of pulmonary tuberculosis and positive sputum. Active tuberculous tracheitis in the absence of parenchymal disease is rare. Still more conclusive proof is obtained by removal of a small specimen of tissue for biopsy; the author has seen four cases in which histologic study showed coincident carcinoma in the presence of active pulmonary tuberculosis.

Superficial ulcerations may be treated biweekly by local application of silver nitrate (10 to 20 per cent); granuloma may require forceps removal or electrocoagulation. Rapid healing may follow administration of streptomycin systemically and by inhalation (0.20 gm. in 1 cc. of physiological saline four or five times daily).

Ulcerative or gummatous *luetic lesions* are rare. The finding of atypical ulceration in the presence of positive serologic test, however, should call for biopsy and dark-field examination of material obtained by swab at the time of tracheoscopy.

Tracheobronchial lesions of *scleroma* occur in about 9 per cent of cases, according to the statistics of Belinoff.[2] This disease, endemic in central and southeastern Europe, and recently in Latin American countries, is occasionally encountered among the native-born of the United States. Although generally thought to be of infectious origin, the primary etiologic rôle of the von Frisch bacillus, which can nearly always be cultured from the lesions, has not been fully proven. Grossly, the lesions may be of diffuse or circumscribed character, with indurative thickening of mucous membrane and subjacent tissues, whose consistency is often that of scar tissue or cartilage Microscopically, the characteristic feature is the presence of Mikulicz cells, within which the bacilli may be found

The laryngotracheal symptoms are those of obstruction, which may be partiallly the result of crusted secretions adherent to the dry mucosal surface Planigraphic study, or films made following instillation of lipiodol (see Fig IV) may show well the extent and degree of the stenosis The immediate indication for treatment may be relief of obstructive dyspnea by tracheotomy Periodic peroral dilatation may prevent occurrence of stenosis in less advanced cases Jackson advocates that patients residing in a region where the disease is endemic should be encouraged to move elsewhere

Response to Roentgen or radium irradiation is generally favorable,[32] though usually temporary, many radiologists feel that such therapy is only palliative In the opinion of Cunning,[8] the sulfonamides are likewise of only temporary value The potentially favorable or curative effect of streptomycin has been described by New, *et al*[27]

Trauma of the trachea occurs infrequently in civilian life,[5] although many instances of such injury were observed in combat[22 23] The resiliency, mobility and compressibility of the structure, its sheltered position and the surrounding cushion of soft tissues protect it from crushing injury Lacerations, penetrating sounds and injury by striking the neck against a narrow-edged object are somewhat more common

In severe lacerations involving the trachea, escape of air into the wound is obvious In other forms of external trauma, subcutaneous or mediastinal emphysema, along with hemoptysis, may indicate rupture of the trachea Spontaneous rupture of the trachea from violent coughing has been reported[25] Wheezing and dyspnea depend on reduction of the tracheal lumen by submucosal hemorrhage and edema, or compression by hematoma external to the trachea

Lacerated wounds involving the trachea may, if relatively clean, be closed with a minimum of drainage, providing injury

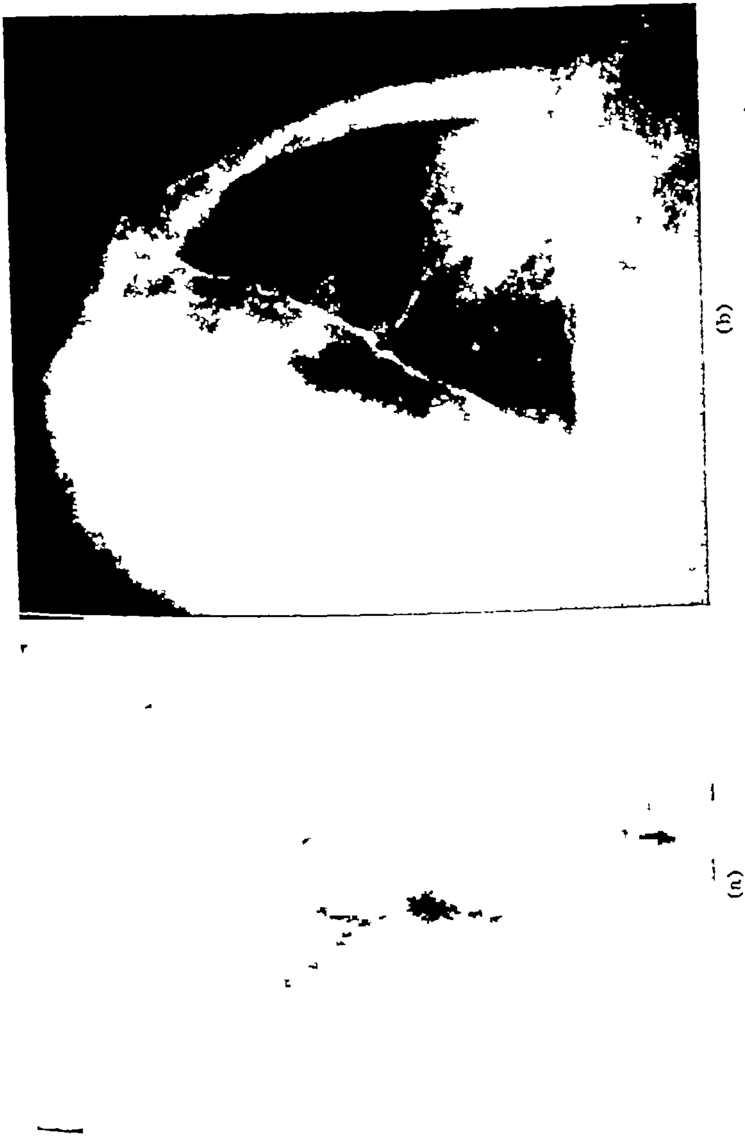


Fig IV Scleroma of the larynx and trachea in a Russian born male of 52 years Dyspnea hoarseness and wheezing of three years duration Diagnosis by tracheoscopic biopsy and bacteriologic study Temporary improvement following deep Roentgen irradiation (a) Planigram (b) Lipiodol tracheogram

to the trachea is not severe Contaminated wounds, or those in which the tracheal wall is badly damaged, should be closed loosely to favor free drainage and a tracheal cannula left *in situ* for several days with adequate systemic biotherapy

In the case of closed wounds, close observation for increasing dyspnea is the most important consideration Asphyxia may be averted by introduction of the bronchoscope, followed by orderly tracheotomy, the cannula being left *in situ* until Roentgen examination, tracheoscopy and clinical trial by corking demonstrate an adequate airway

The problem of treatment of cicatricial stenosis occurring as an end-result of perichondritis of the tracheal cartilages is discussed below Cases in which stenosis occurs as a result of blast injury or exposure to noxious gases, such as those reported by Knight,[2] present a similar problem

Chronic Cicatricial Tracheal Stenosis Cicatricial narrowing of the trachea may be observed as a sequel to trauma, but more often, the condition represents the healed end-result of a chronic granulomatous lesion (tuberculosis, scleroma, lues, etc) Cicatrization of a tuberculous lesion is the most common cause Appreciable degrees of cicatricial narrowing at the site of tracheotomy are unusual, even when the cannula has been worn for prolonged periods, providing the tracheotomy has been performed at the proper level to avoid contact with the cricoid cartilage, however, persisting obstructive granuloma at the inner end of the tracheotomic fistula may be evident when decannulation is attempted, particularly in young children, and may require forceps removal

Careful preliminary Roentgen and tracheoscopic study is a prerequisite to treatment, planigraphic films may be especially helpful Keen,[10] in 1924, described an operation for cicatricial stenosis of the trachea, and recently Daniel[9] has demonstrated the ability of the trachea and larger bronchi to regenerate around hollow tubes of glass, plastic or inert metal Taffel[17] has described the use of free fascia grafts in the repair of defects of the tracheal wall

The more conservative treatment consists in either *1* peroral dilatation, using smooth-tipped bronchoscopes in increasing sizes or metal bougies of the type used in treating laryngeal stenosis, or *2* use of indwelling apparatus of rubber or plastic, if the stenosis is at such a level that a tracheal cannula may be left *in situ* below the apparatus Tracheostomy may be required to insert such apparatus initially, the "core-mold" may be anchored to the tracheal cannula or to a segment of rubber tubing lying on the skin surface, the latter method has the advantage of allowing daily changing of the tracheal cannula Rubber dilators may be changed weekly, with increase in size until a No 36 to No 40F in the average adult is tolerated for a period of three to four weeks A test period of several months without apparatus is required before decannulation is attempted

The technique of Erich,[11] in which excision of scar tissue and skin grafting are followed by the wearing of an acrylic mold, is likewise applicable to stenosis of the upper trachea and is said to accomplish restoration of an adequate tracheal lumen in a somewhat shorter period of time

Peroral dilatation of a cicatricial tracheal stenosis cannot be accomplished rapidly Progress must be slow, for excessive stretching is likely to be followed by a temporary increase in obstructive dyspnea, which may be a serious problem if a tracheal cannula is not being worn, and even more so when tracheotomy is not feasible, as in stenosis near the lower end of the trachea In cases where impairment of bronchopulmonary drainage is evident, frequent bronchoscopic aspiration beyond the stenosis may be helpful

Tumors of the Trachea The relative infrequency of tracheal tumors is indicated by the statistics of various authors relating their incidence to that of laryngeal tumors These ratios, as cited in the paper of D'Aunoy and Zoeller,[10] are 1 100 (Semon), 7 300 (von Bruns), 3 748 (Schmidt) and 4 800 (Mackenzie) D'Aunoy and Zoeller, in 1929, were able to collect 351 reported cases of primary tracheal tumors, in this group, benign and malignant tumors occurred with about equal frequency

Benign papilloma is the most common of the truly neoplastic benign tumors, and fibroma is second in frequency The coincidence of benign papilloma of the trachea and tracheal ectasia has been observed [1] Other benign neoplasms less is not essential, the administration of barium is avoided, unless necessary for localization of perforating nonopaque foreign bodies

Although some cases of mediastinitis due to foreign body or instrumental perforation may respond to biotherapy (especially if the perforation is large enough to allow adequate internal drainage) the occurrence of tracheal dyspnea is an indication for surgical drainage, this is usually accomplished by cervical mediastinotomy, following preliminary insertion of a bronchoscope or endotracheal catheter, the prevertebral space being opened through the interval between the sternomastoid muscle and carotid sheath, laterally, and the thyroid gland, trachea and esophagus medially If, following drainage, dyspnea recurs when the bronchoscope or endotracheal catheter is withdrawn to the glottic level, a tracheal cannula should be introduced through a separate incision Intensive biotherapy, controlled by culture and susceptibility tests, and attention to oral hygiene are indicated, saliva should be expectorated rather than swallowed Usually a feeding tube can be introduced if this is done under fluoroscopic guidance with care, otherwise, parenteral feeding is required temporarily

Tracheal compression due to *enlarged thymus*, and that due to *esophageal foreign body*, have been mentioned above Other types of compression, developing more slowly, are those of substernal goiter, thyroid carcinoma or abscess of the thyroid gland, aneurysm of the aorta or subclavian artery [see Fig VI (b)], benign tumor of the upper mediastinum, mediastinal cyst, invasive tumor of bronchogenic [see Fig VI (c)] or esophageal [see Fig VI (a)] origin, and mediastinal lymphadenopathy (inflammatory, metastatic tumor, lymphoblastoma) Heuer[13] found primary lymphoblastoma and metastatic lymphadenopathy of about equal frequency, most of the cases of the latter represent extension from a bronchogenic carcinoma Differential diagnosis will require, in addition to careful general examination and indirect laryngoscopy, Roentgen examination of the neck, chest and esophagus, and may require *1* biopsy of any enlarged cervical nodes, *2* bronchoscopy or esophagoscopy or both, except in cases where aneurysm is a

(a) (b) (c)

Fig. VI (a) Tracheal compression by carcinoma of esophagus in a white male of 69 years (b) Tracheal compression by luetic aneurysm of the subclavian artery in a white male of 40 years (c) Tracheal compression by bronchogenic carcinoma infiltrating mediastinum frequently seen are adenoma, cylindroma, "mixed tumor," lipoma, angioma, chondroma and osteoma The nature of the tumor must, of course, be determined by tracheoscopic biopsy Benign tumor-like conditions, not truly neoplastic, are intratracheal goiter, amyloid tumor and tracheopathia osteoplastica (multiple osteochondromata)

Papilloma and fibroma are adequately treated by tracheoscopic removal, and the same is true of other benign neoplasms, except for those which are integral with the tracheal wall In the case of vascular lesions, electrocoagulation is preferred to forceps removal Pedunculated tumors may be removed with the snare

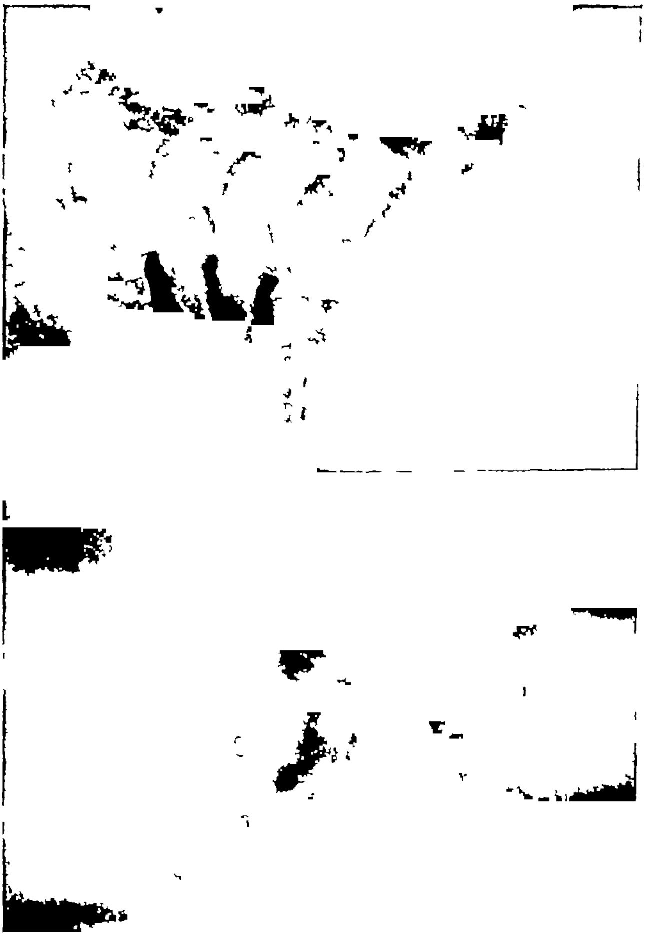
The incidence of *malignant tumors of the trachea* as compared to that of adjacent portions of the respiratory tract, is surprisingly low Culp,[7] in 1938, found only 82 reported cases of histologically proven primary carcinoma of the trachea, and Schoolman[34] found only five carcinomas of the trachea during a period in which 137 carcinomas of the larynx were seen The relative frequency, as compared to the incidence of primary malignant bronchial tumors, is probably no greater than 2 per cent As to sex, the male predominates in ratio of about 2 1

In somewhat more than half of the cases, the lower third of the trachea appears to be the site of origin The posterior wall is said to be more frequently involved than the lateral wall and anterior wall Squamous cell carcinoma and adenocarcinoma occur with about equal frequency The "cylindroma" type of adenocarcinoma, usually of low-grade malignancy, is identified microscopically by the occurrence of columns of small cells of uniform size, with infrequent mitoses but some tendency for formation of acini containing mucus This type of tumor must be differentiated from the benign adenoma and the so-called "mixed tumor " Microscopic appraisal of degree of malignancy, according to the criteria of Broders, allows some estimate of the rapidity with which local invasion and metastasis may be expected to occur Metastases, more commonly seen in the squamous cell than in other histologic types, are usually to the mediastinal, cervical or peribronchial nodes, distant metastases are unusual Local invasion of adjacent structures is, of course, relatively common

The most characteristic clinical manifestation of tracheal tumor is the "asthmatoid wheeze," which, in the early stages, is best heard at the open mouth near the end of a forced expiration, is increased by exertion, and may, if the tumor is pedunculated, be affected by change of position The accompanying dyspnea is of increasing severity, paroxysmal exacerbations may occur if the lesion is pedunculated, but more often such episodes, usually nocturnal, accompany the accumulation of secretions due to obstructed tracheobronchial drainage Cough is not always an early symptom, but paroxysmal cough and expectoration of purulent sputum occur when the increasing obstruction results in impaired drainage and secondary infection Hemoptysis and blood-streaking are commonly observed The initial symptoms may be those of esophageal invasion (dysphagia, regurgitation), or recurrent nerve paralysis (hoarseness)

The presence and location of the tracheal tumor may be well shown by the lateral Roentgenogram, or the planigraphic Roentgen film [see Fig V (a)] Films made following instillation of iodized oil may likewise demonstrate the lesion

Tracheoscopy with biopsy under direct vision is the only procedure by which accurate diagnosis may be established General anesthesia for this procedure should be avoided, particularly in the presence of obstructive dyspnea, and facilities for the endoscopic insufflation of oxygen should be available The gross appearance of a malignant tracheal tumor varies to some degree with the histologic type, the squamous cell carcinomas of high malignancy present an ulcerated, nodular or fungating surface which may involve a large portion of the circumference of the lumen Adenocarcinomas of low grade may be more localized to the point of origin, or even pedunculated, with a surface which is smooth or lobulated The "cylindroma" type of adenocarcinoma may be covered with mucous membrane which is entirely smooth



(a) (b)

Fig V (a) Adenocarcinoma of the trachea in a colored female of 35 years Increasing dyspnea wheezing and productive cough of four years duration Diagnosis by tracheoscopic biopsy treatment by forceps removal electrocoagulation and deep Roentgen irradiation Recurrence six years after treatment death from pulmonary metastases nine years after initial treatment. (b) Adenocarcinoma of thyroid gland infiltrating trachea of a white male of 58 years Increasing dyspnea and wheezing of about one year's duration Diagnosis by tracheoscopic biopsy No cervical node metastases palpable Thyroidectomy and laryngotracheoectomy (Dr W Wayne Babcock) living without evidence of recurrence or metastasis after three years

The differential diagnosis[10] includes endotracheal lesions of other types (benign tumor, granuloma, specific or nonspecific ulcerative lesions, cicatricial stenosis), as well as extratracheal lesions which may, by compression, narrow the tracheal lumen (aneurysm, esophageal tumor, or foreign body, lymphoblastoma or other space-taking mediastinal lesion) Other causes of wheezing respirations (bronchial asthma, bronchial foreign body, and partially obstructive lesions of the larger bronchi) may also require differentiation Cases in which a tumor of bronchial origin appears to have extended proximally to

relief of temporary nature may accompany administration of oxygen or oxygen-helium mixture, preferably by mask

Suppurative bronchopulmonary infection will require, in addition to periodic bronchoscopic aspiration, use of sulfonamides, penicillin or streptomycin, depending upon the susceptibility of the organisms cultured from the tracheobronchial secretions In instances where esophageal obstruction has occurred, as a result of invasion or compression, gastrostomy may be required for feeding, gastrostomy is also indicated if a tracheoesophageal fistula is present, and an effort should be made to improve oral hygiene

Complete extirpation of a malignant tumor by endoscopic removal is usually not possible, although Broyles[5] has reported a case of squamous cell carcinoma surviving 11 years after treatment by fulguration Curative treatment by surgical resection is possible only if the lesion is limited to the upper third of the trachea In a few instances, if the tumor is pedunculated or well localized, removal by tracheofissure, with excision or electrocoagulation, may be feasible More extensive lesions will require resection of a portion of the upper trachea and adjacent structures, partial or total laryngectomy may be necessary Presence of cervical node metastases calls for complete neck dissection The likelihood of recurrence is somewhat diminished by implantation of radon seeds at the time of operation, but the potency and distribution of the seeds should be such that necrosis of remaining cartilage will not occur

The prognosis in carcinoma of the trachea is generally unfavorable Lesions of the upper trachea are more amenable to either surgical treatment or irradiation, and offer a somewhat better prognosis than those at lower levels The adenocarcinomas of low grade appear to be the most favorable histologic type

Tracheal Compression The clinical manifestations of partial tracheal obstruction due to compression are essentially the same as those of intrinsic or intratracheal obstruction Wheezing and dyspnea are predominantly expiratory, though less so when the cervical trachea is compressed, the characteristic "brassy" cough idicative of compression of the thoracic trachea is well known Other symptoms, signs and Roentgen findings are those of the pathology responsible for the compression

Compression by hematoma, with dyspnea, may occur following injury or following operations on the neck Since thyroidectomy is one of the more common operations prone to be followed by this complication, it is important to differentiate dyspnea due to tracheal compression from that due to bilateral injury of the recurrent laryngeal nerves The latter condition is characterized by inspiratory dypsnea, inspiratory stridor and impairment or loss of voice in the initial stages, indirect laryngoscopy will show the vocal cords motionless in the midline, and tracheotomy will be required in many instances

Differentiation of compression by hematoma following trauma from obstruction due to injury of the trachea itself may be difficult, although occurrence of hemoptysis and presence of interstitial emphysema speak for the latter The indications for treatment, if dyspnea is marked, are the same in these conditions as in postoperative hematoma A bronchoscope or long endotracheal catheter should be introduced and the trachea exposed by external incision (or reopening of the incision in the postoperative cases) Arrest of bleeding and evacuation of hematoma if present will relieve the compression If the tracheal wall has suffered considerable injury, a tracheal cannula may be inserted

Compression due to acute infection may be observed in periesophageal cellulitis, retroesophageal abscess or mediastinitis due to foreign body or instrumental perforation of the hypopharynx or cervical esophagus Roentgen study is extremely helpful,[70] the lateral film [see Fig III (b)] is of particular value in demonstrating the degree of widening of the retrotracheal soft-tissue zone and the tracheal compression Presence of interstitial air is nearly always conclusive evidence of perforation, since knowledge of the exact site of perforation relief of temporary nature may accompany administration of oxygen or oxygen-helium mixture, preferably by mask

Suppurative bronchopulmonary infection will require, in addition to periodic bronchoscopic aspiration, use of sulfonamides, penicillin or streptomycin, depending upon the susceptibility of the organisms cultured from the tracheobronchial secretions In instances where esophageal obstruction has occurred, as a result of invasion or compression, gastrostomy may be required for feeding, gastrostomy is also indicated if a tracheoesophageal fistula is present, and an effort should be made to improve oral hygiene

Complete extirpation of a malignant tumor by endoscopic removal is usually not possible, although Broyles[5] has reported a case of squamous cell carcinoma surviving 11 years after treatment by fulguration Curative treatment by surgical resection is possible only if the lesion is limited to the upper third of the trachea In a few instances, if the tumor is pedunculated or well localized, removal by tracheofissure, with excision or electrocoagulation, may be feasible More extensive lesions will require resection of a portion of the upper trachea and adjacent structures, partial or total laryngectomy may be necessary Presence of cervical node metastases calls for complete neck dissection The likelihood of recurrence is somewhat diminished by implantation of radon seeds at the time of operation, but the potency and distribution of the seeds should be such that necrosis of remaining cartilage will not occur

The prognosis in carcinoma of the trachea is generally unfavorable Lesions of the upper trachea are more amenable to either surgical treatment or irradiation, and offer a somewhat better prognosis than those at lower levels The adenocarcinomas of low grade appear to be the most favorable histologic type

Tracheal Compression The clinical manifestations of partial tracheal obstruction due to compression are essentially the same as those of intrinsic or intratracheal obstruction Wheezing and dyspnea are predominantly expiratory, though less so when the cervical trachea is compressed, the characteristic "brassy" cough idicative of compression of the thoracic trachea is well known Other symptoms, signs and Roentgen findings are those of the pathology responsible for the compression

Compression by hematoma, with dyspnea, may occur following injury or following operations on the neck Since thyroidectomy is one of the more common operations prone to be followed by this complication, it is important to differentiate dyspnea due to tracheal compression from that due to bilateral injury of the recurrent laryngeal nerves The latter condition is characterized by inspiratory dypsnea, inspiratory stridor and impairment or loss of voice in the initial stages, indirect laryngoscopy will show the vocal cords motionless in the midline, and tracheotomy will be required in many instances

Differentiation of compression by hematoma following trauma from obstruction due to injury of the trachea itself may be difficult, although occurrence of hemoptysis and presence of interstitial emphysema speak for the latter The indications for treatment, if dyspnea is marked, are the same in these conditions as in postoperative hematoma A bronchoscope or long endotracheal catheter should be introduced and the trachea exposed by external incision (or reopening of the incision in the postoperative cases) Arrest of bleeding and evacuation of hematoma if present will relieve the compression If the tracheal wall has suffered considerable injury, a tracheal cannula may be inserted

Compression due to acute infection may be observed in periesophageal cellulitis, retroesophageal abscess or mediastinitis due to foreign body or instrumental perforation of the hypopharynx or cervical esophagus Roentgen study is extremely helpful,[20] the lateral film [see Fig III (b)] is of particular value in demonstrating the degree of widening of the retrotracheal soft-tissue zone and the tracheal compression Presence of interstitial air is nearly always conclusive evidence of perforation, since knowledge of the exact site of perforation is not essential, the administration of barium is avoided, unless necessary for localization of perforating nonopaque foreign bodies

Although some cases of mediastinitis due to foreign body or instrumental perforation may respond to biotherapy (especially if the perforation is large enough to allow adequate internal drainage) the occurrence of tracheal dyspnea is an indication for surgical drainage, this is usually accomplished by cervical mediastinotomy, following preliminary insertion of a bronchoscope or endotracheal catheter, the prevertebral space being opened through the interval between the sternomastoid muscle and carotid sheath, laterally, and the thyroid gland, trachea and esophagus medially If, following drainage, dyspnea recurs when the bronchoscope or endotracheal catheter is withdrawn to the glottic level, a tracheal cannula should be introduced through a separate incision Intensive biotherapy, controlled by culture and susceptibility tests, and attention to oral hygiene are indicated, saliva should be expectorated rather than swallowed Usually a feeding tube can be introduced if this is done under fluoroscopic guidance with care, otherwise, parenteral feeding is required temporarily

Tracheal compression due to *enlarged thymus,* and that due to *esophageal foreign body,* have been mentioned above Other types of compression, developing more slowly, are those of substernal goiter, thyroid carcinoma or abscess of the thyroid gland, aneurysm of the aorta or subclavian artery [see Fig VI (b)], benign tumor of the upper mediastinum, mediastinal cyst, invasive tumor of bronchogenic [see Fig VI (c)] or esophageal [see Fig VI (a)] origin, and mediastinal lymphadenopathy (inflammatory, metastatic tumor, lymphoblastoma) Heuer[13] found primary lymphoblastoma and metastatic lymphadenopathy of about equal frequency, most of the cases of the latter represent extension from a bronchogenic carcinoma Differential diagnosis will require, in addition to careful general examination and indirect laryngoscopy, Roentgen examination of the neck, chest and esophagus, and may require *1* biopsy of any enlarged cervical nodes, *2* bronchoscopy or esophagoscopy or both, except in cases where aneurysm is a

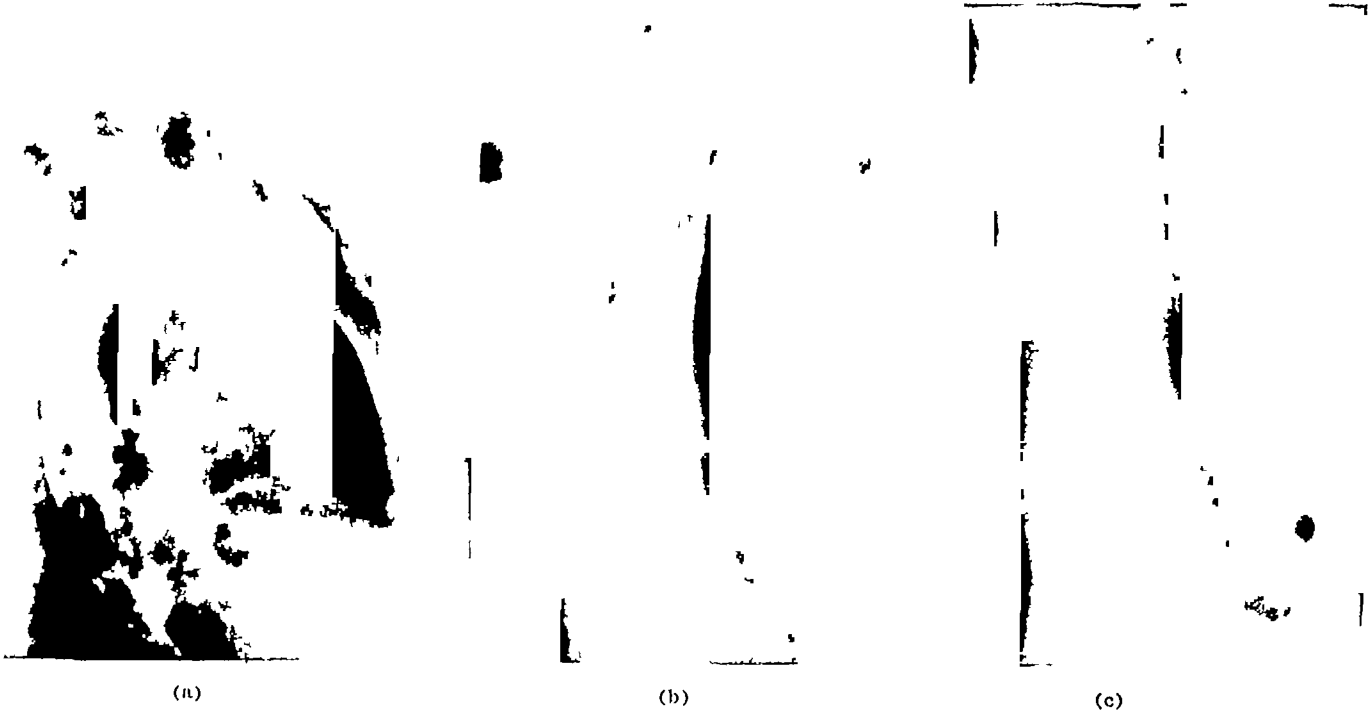


Fig. VI (a) Tracheal compression by carcinoma of esophagus in a white male of 69 years (b) Tracheal compression by luetic aneurysm of the subclavian artery in a white male of 40 years (c) Tracheal compression by bronchogenic carcinoma infiltrating mediastinum is *not* essential, the administration of barium is avoided, unless necessary for localization of perforating nonopaque foreign bodies

Although some cases of mediastinitis due to foreign body or instrumental perforation may respond to biotherapy (especially if the perforation is large enough to allow adequate internal drainage) the occurrence of tracheal dyspnea is an indication for surgical drainage, this is usually accomplished by cervical mediastinotomy, following preliminary insertion of a bronchoscope or endotracheal catheter, the prevertebral space being opened through the interval between the sternomastoid muscle and carotid sheath, laterally, and the thyroid gland, trachea and esophagus medially If, following drainage, dyspnea recurs when the bronchoscope or endotracheal catheter is withdrawn to the glottic level, a tracheal cannula should be introduced through a separate incision Intensive biotherapy, controlled by culture and susceptibility tests, and attention to oral hygiene are indicated, saliva should be expectorated rather than swallowed Usually a feeding tube can be introduced if this is done under fluoroscopic guidance with care, otherwise, parenteral feeding is required temporarily

Tracheal compression due to *enlarged thymus*, and that due to *esophageal foreign body*, have been mentioned above Other types of compression, developing more slowly, are those of substernal goiter, thyroid carcinoma or abscess of the thyroid gland, aneurysm of the aorta or subclavian artery [see Fig VI (b)], benign tumor of the upper mediastinum, mediastinal cyst, invasive tumor of bronchogenic [see Fig VI (c)] or esophageal [see Fig VI (a)] origin, and mediastinal lymphadenopathy (inflammatory, metastatic tumor, lymphoblastoma) Heuer[13] found primary lymphoblastoma and metastatic lymphadenopathy of about equal frequency, most of the cases of the latter represent extension from a bronchogenic carcinoma Differential diagnosis will require, in addition to careful general examination and indirect laryngoscopy, Roentgen examination of the neck, chest and esophagus, and may require *1* biopsy of any enlarged cervical nodes, *2* bronchoscopy or esophagoscopy or both, except in cases where aneurysm is a

15 Jackson, Chevalier Wheezing Respirations in Children. *Amer Jour Dis Child*, 41 153 157, Jan , 1931

16 Jackson, Chevalier Tumors of the Trachea *South Surg* 5 262-276 Aug., 1936

17 Jackson, C, and Jackson, C L Benign Tumors of the Trachea and Bronchi with Especial Reference to Tumor like Formations of Inflammatory Origin *Jour A M A*, 99 1747 1754, Nov 19 1932

18 Jackson, C, and Jackson, C L Acute Infective Laryngotracheobronchitis *Jour A M A* 107 929 933, Sept 19, 1936

19 Jackson, C, and Keen, W W The Keen Operation for Cicatricial Tracheal Stenosis *Jour A. M A.*, 82 2027-2028 June 21, 1924

20 Jackson, Chevalier, L Value of Roentgenography of the Neck. *Ann Otol., Rhinol and Laryngol*, 45 1178, Dec 1936

21. Kernan, J D Congenital Papilloma of the Trachea *Ann Otol, Rhinol and Laryngol*, 54 865 869, Sept., 1936

22 Knight, J S Injuries to the Trachea and Esophagus Incurred in Combat. *Ann Otol, Rhinol and Laryngol*, 55 656 666, Sept 1946

23 Lederer, F L. and Howard, J C Wartime Laryngeal Injuries *Arch Otolaryngol*, 43 331-343, Apr 1946

24 Myerson, M. C Tuberculosis of the Trachea and Bronchus *Jour A. M A*, 116 1611 1615, Apr 12 1941

25 Nach, R. L. and Rothman M Injuries to the Larynx and Trachea *Surg, Gynec and Obst* 76 614 622, May, 1943

26 Neuhauser, E B D The Roentgen Diagnosis of Double Aortic Arch and Other Anomalies of the Great Vessels *Amer Jour, Roentgenol* 56 1 12 July 1946

27 New, G B, Weed, L A., Nichols, D R and Devine, K D Rhinoscleroma Apparently Cured with Streptomycin *Ann Otol Rhinol and Laryngol*, 57 412-417 Jan 1948

28 Norris Charles M Foreign Bodies in the Air and Food Passages a Series of 250 Cases *Ann Otol, Rhinol and Laryngol*, 57 1049 1071 Dec 1948

29 Olsen A. E Carcinoma of the Trachea *Arch Otolaryngol*, 30 615 630 Oct 1939

30 Pancoast H K Roentgenology of the Thymus in Infancy and Differential Diagnosis of Enlarged Thymus and Its Treatment *Amer Jour Med Sci*, 180 745 767, Dec 1930

31 Proileau W H The Treatment of Abscess of the Thyroid Gland Causing Tracheal Obstruction *Surg* 14 871 875 Dec 1943

32 Reyes, E Rhinoscleroma *Arch Dermat and Syph*, 54 531 537 Nov, 1946

33 Samson P C Diagnosis Treatment and Prognosis in Tuberculous Tracheobronchitis *Jour Thoracic Surg.*, 6 561 582 June 1937

34 Schoolman J G Incidence of Malignant Neoplastic Diseases of the Head and Neck. *Ann Otol Rhinol and Laryngol*, 55 789 794 Dec, 1946

35 Sweaney H C and Behm Hugo Tuberculosis of Trachea and Major Bronchi *Dis of Chest*, 14 1 18 Jan Feb 1948

36 Sweet, R. H, Findlay, C W and Reyersbach G C The Diagnosis and Treatment of Tracheal and Esophageal Obstruction Due to Congenital Vascular Ring *Jour Pediat*, 30 1 17 Jan 1947

likely possibility, *3* planigraphic Roentgen examination, and *4* possibly needle aspiration biopsy under fluoroscopic guidance Laboratory procedures which may be relevant include serologic study for lues, differential blood count with particular attention to young forms, sternal marrow biopsy, cytologic study of bronchial secretions and basal metabolism

SUMMARY

1 General characteristics of the phenomenon of tracheal obstruction are discussed

2 Diagnostic features of the various types of tracheal obstruction are described and their treatment indicated

3 Illustrative cases are presented

BIBLIOGRAPHY

1 Auerbach, O Perforation of Tuberculous Lymph Nodes into the Trachea and Bronchi *Arch Otolaryngol*, 39 527 532 June, 1944

2 Belinoff, S Rapp Cong internat d'otorhinolaryng Madrid 1932, p 362 *Ztrlbl f Hals*, *Nasen u Ohrenh*, 26 193 209, Mar 25, 1936

3 Benedict, E B Bronchial Obstruction and Tracheobronchial Tuberculosis *N Eng Jour Med*, 227 1013 1021, Dec 31, 1942

4 Bowman, J E, and Jackson, Chevalier L Chronic Stridor in Infancy *Jour Pediat*, 15 476 484, Oct, 1939

5 Broyles, E N Bronchoscopic Experiences with Tumors of the Lower Respiratory Tract *Ann Otol*, *Rhinol and Laryngol*, 57 129 133 Mar, 1948

6 Burnett, W E Recognition and Management of Mediastinitis *Amer Jour Surg*, 54 99 113, Oct, 1941

7 Culp, O S Primary Carcinoma of the Trachea *Jour Thoracic Surg*, 7 471-487, June, 1938

8 Cunning, D S, and Guerry, D III Scleroma *Arch Otolaryngol* 36 662 678, Nov 1942

9 Daniel, R A, Jr The Regeneration of Defects of the Trachea and Bronchi *Jour Thoracic Surg*, 17 335 349, June, 1948

10 D'Aunoy, R, and Zoeller, A Primary Tumors of the Trachea *Arch Pathol*, 11 589 600, Apr, 1931

11 Erich, J B Treatment of Extensive Cicatricial Stenosis of the Larynx and Trachea *Arch Otolaryngol*, 41 343 350 May, 1945

12 Gross, R E Surgical Relief for Tracheal Obstruction from a Vascular Ring *N Eng Jour Med*, 233 586 590 Nov 15 1945

13 Heuer, G J Surgical Treatment of Tumors of the Mediastinum *Ann Surg* 113 357 363 Mar 1941

14 Jackson Chevalier The 'Asthmatoid Wheeze', a New Diagnostic Sign *Amer Jour Med Sci*, 156 625, Nov, 1918

15 JACKSON CHEVALIER Wheezing Respirations in Children. *Amer Jour Dis Child*, 41 153 157 Jan 1931.

16 JACKSON CHEVALIER Tumors of the Trachea *South Surg.*, 5 262-276 Aug 1936

17 JACKSON, C and JACKSON, C L Benign Tumors of the Trachea and Bronchi with Especial Reference to Tumor like Formations of Inflammatory Origin. *Jour A M A.* 99 1747-1754 Nov 19 1932

18 JACKSON, C and JACKSON C L Acute Infective Laryngotracheobronchitis *Jour A. M A.* 107 929 933 Sept 19, 1936

19 JACKSON, C and KEEN, W W The Keen Operation for Cicatricial Tracheal Stenosis *Jour A. M A.*, 82 2027 2028 June 21 1924

20 JACKSON CHEVALIER, L Value of Roentgenography of the Neck. *Ann Otol., Rhinol and Laryngol* 45 1178 Dec 1936

21. KERNAN, J D Congenital Papilloma of the Trachea *Ann Otol., Rhinol and Laryngol*, 54 865 869, Sept. 1936

22 KNIGHT, J S Injuries to the Trachea and Esophagus Incurred in Combat. *Ann Otol, Rhinol and Laryngol*, 55 656-666 Sept 1946

23 LEDERER, F L. and HOWARD J C Wartime Laryngeal Injuries *Arch Otolaryngol.*, 43 331-343, Apr, 1946

24 MYERSON, M. C Tuberculosis of the Trachea and Bronchus *Jour A. M A.*, 116 1611 1615, Apr 12 1941

25 NACH. R. L. and ROTHMAN M Injuries to the Larynx and Trachea. *Surg., Gynec and Obst* 76 614-622 May, 1943

26 NEUHAUSER. E B D The Roentgen Diagnosis of Double Aortic Arch and Other Anomalies of the Great Vessels *Amer Jour Roentgenol* 56 1 12 July 1946

27 NEW, G B, WEED L A. NICHOLS D R and DEVINE, K. D Rhinoscleroma Apparently Cured with Streptomycin *Ann Otol Rhinol and Laryngol.*, 57 412-417 Jan., 1948

28 NORRIS CHARLES M Foreign Bodies in the Air and Food Passages a Series of 250 Cases *Ann Otol Rhinol and Laryngol.* 57 1049 1071 Dec. 1948

29 OLSEN A. E Carcinoma of the Trachea *Arch Otolaryngol* 30 615-630 Oct., 1939

30 PANCOAST H K Roentgenology of the Thymus in Infancy and Differential Diagnosis of Enlarged Thymus and Its Treatment *Amer Jour Med Sci*, 180 745 767 Dec 1930

31 PRIOLEAU W H The Treatment of Abscess of the Thyroid Gland Causing Tracheal Obstruction *Surg* 14 871-875 Dec 1943

32 REYES, E Rhinoscleroma *Arch Dermat and Syph* 54 531 537 Nov., 1946

33 SAMSON P C Diagnosis Treatment and Prognosis in Tuberculous Tracheobronchitis *Jour Thoracic Surg.* 6 561 582 June 1937

34 SCHOOLMAN J G Incidence of Malignant Neoplastic Diseases of the Head and Neck. *Ann Otol Rhinol and Laryngol.*, 55 789 794 Dec 1946

35 SWEANEY, H C and BEHM HUGO Tuberculosis of Trachea and Major Bronchi *Dis of Chest* 14 1 18 Jan.-Feb 1948

36 SWEET R. H FINDLAY C W., and REYERSBACH G C The Diagnosis and Treatment of Tracheal and Esophageal Obstruction Due to Congenital Vascular Ring *Jour Pediat* 30 1 17 Jan 1947

37 TAFFEL, M The Repair of Tracheal and Bronchial Defects with Free Fascia Grafts *Surg*, 8 56 71, July, 1940

38 TINNEY, W S, MOERSCH, H J, and McDONALD, J R Tumors of the Trachea *Arch Otolaryngol*, 41 284 299, Apr, 1945

39 TUCKER, G Congenital Cyst of the Mediastinum Producing Compression of Lower Trachea and Esophagus *Ann Otol, Rhinol and Laryngol*, 55 693 694, Sept, 1946

3401 North Broad Street

DR SEYMOUR H RINZLER, NEW YORK UNIVERSITY, WINS 1949 MISSISSIPPI VALLEY MEDICAL SOCIETY ESSAY CONTEST

Seymour H Rinzler, B A, M D, F A C P Adjunct in Medicine and Cardiology, Beth Israel Hospital, and Instructor in Rehabilitation, New York University, is the winner of the ninth annual essay contest of the Mississippi Valley Medical Society "for the best unpublished essay on a subject of practical and applicable value to the general practioner of medicine" Dr Rinzler's paper is *entitled*, "Present Status of Medical and Surgical Therapy in Angina Pectoris" Second prize goes to Dr Edward D Robbins, of the University of Chicago, for his essay, "Hypometabolism or Hypothyroidism," and third prize to Dr Wallis L Craddock, Ft Logan, Colo, for his paper, "The Problem of Histoplasmosis"

Dr Rinzler will receive a cash award, a gold medal, a certificate of award, and will present his essay at the Fourteenth Annual Meeting, Mississippi Valley Medical Society, Jefferson Hotel, St Louis, Sept 28, 29, 30 His paper and those of Dr Robbins and Dr Craddock will appear in the January, 1950, issue of the *Mississippi Valley Medical Journal* (Quincy, Ill)

TREATMENT OF CARCINOMA OF THE LARYNX
A STATISTICAL STUDY OF RESULTS*

CLAUDE C. CODY, JR., M.D.,
Houston, Tex.

The statistical method measures the efficiency of different treatments for the same disease. The wider the source of the statistics in number of cases, in time and area, the more accurately they reflect the general rule. Carcinoma of the larynx has large variations in symptoms, malignancy, treatment and prognosis. New operations and irradiation under their respective indications as the method of choice have been increasingly suggested during the past decade as either equal or superior in some respects to those usually employed. Consequently, a statistical study on a broad factual basis of the results of therapy may be of value in establishing the general rule for the respective indications of the several treatments as well as their prognosis.

The source of the statistics are the reports on the results of treatment for carcinoma of the larynx for a five-year period, which have appeared in the American and English medical literature during the past 10 years. Many reports, otherwise excellent, are not included because the five-year results could not be accurately identified. The series has a total number of 4,584 cases, of which 2,213 have a report on some phase of five-year results, and 2,371 are untraced or less than five years. The series is based upon the reports of—omitting joint authors—Arbuckle,[1] Bernheimer,[2] Brunschwig, Clerf,[4] Colledge,[5] Coutard,[6] Cunning, Cutler,[8] Desjardins,[9]

---

*Read at the Fifty-third Annual Meeting of the American Laryngological Rhinological and Otological Society, Inc., Chicago, Ill., April 18, 1949.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication April 25, 1949.

Hare,[10] Howes,[11] C L Jackson,[12] Kernan,[13] LeJeune,[14] Lentz,[15] Lederman,[16] McCall,[17] Negus,[18] New,[19] Orton,[20] Schall,[1] Tucker,[22] and my own small group Acknowledgment is made of the free use of the material cited above The reports follow no fixed pattern, so that the number of cases reported on the results of different types of treatment has wide variations, some being large and others relatively small The consolidation of these results has been made to compare the relative efficiency of the several methods of treatment

The type of treatment for carcinoma of the larynx is largely determined by the age, the physical condition of the patient, the site, size and degree of malignancy of the tumor, and the motility of the vocal cords Fig 1 shows the age incidence in percentage by decades The curve of incidence demonstrates that laryngeal cancer covers the span of life from the early "teens" to 90 years and beyond these limits will very rarely be found The physical condition of a patient occasionally determines whether definitive treatment can be undertaken Patients with chronic pulmonary tuberculosis, diabetes and cardiovascular disease are poor risks for either surgery or irradiation The site of the initial lesion occurs in the order of frequency on the vocal cord, supraglottic, subglottic and extrinsic areas In cancer clinics, however, the neoplasm may occur more often in the supraglottic area, *i e*, epiglottis, aryepiglottic fold, ventricular band and in the ventricle, than on the vocal cord The symptoms are dependent, of course, on the location and extent of the tumor Cancer of the vocal cord has hoarseness as an early symptom, but elsewhere there are no early symptoms The first indication of a subglottic, supraglottic or extrinsic cancer may be one or the other of dyspnea, odynophagia, dysphagia, hemoptysis and metastasis to the cervical lymph nodes Pain in the throat or the ear is a late symptom

Diagnosis is the beginning of treatment A biopsy is primarily for differential diagnosis between cancer and keratosis, papilloma, granulations, tuberculosis, syphilis and moniliasis, and secondarily for estimating the degree of malignancy

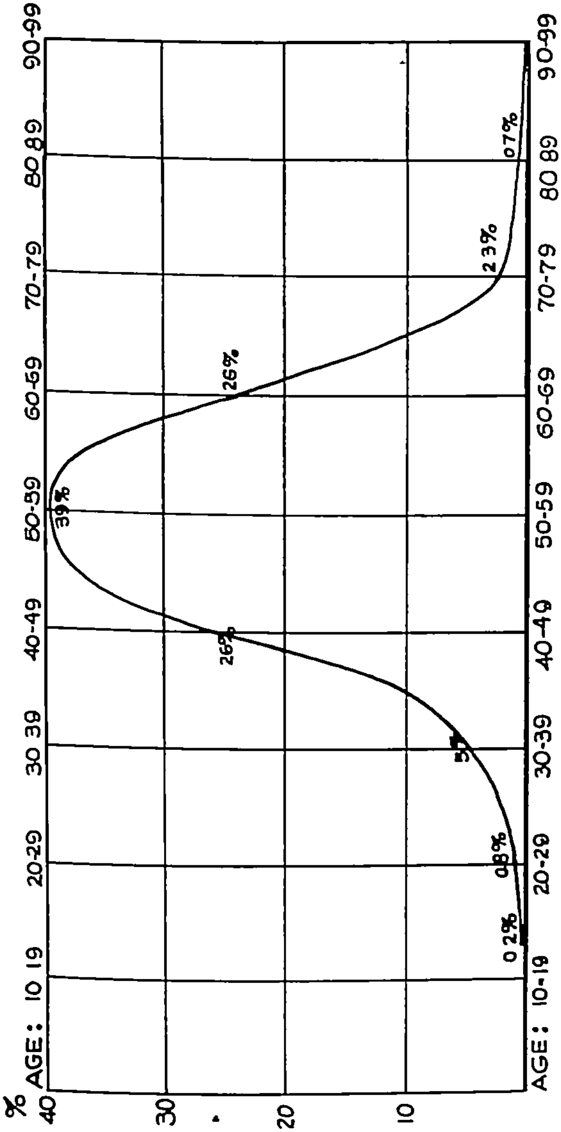


Fig 1 Age incidence of carcinoma of larynx.

keratosis and recurrent papilloma in the adult are wolves in sheep's clothing and are assumed to be malignant until contrarily proven The biopsy is essentially a sampling process and subject to the inherent advantages and weaknesses of such a method For this reason, it may be necessary to repeat a biopsy several times to prove the diagnosis The value of the biopsy in determining the degree of malignancy and of radiosensitivity is at present controversial The consensus now is that Broder's Grades 3 and 4, or anaplastic cancer, have a higher mortality rate than Grades 1 and 2, or the epidermoid, whether treated by surgery or irradiation, that Grades 1 and 2 in a large majority of cases are not radioresistant, and that a radiosensitive cancer is not necessarily radiocurable Cordal cancer is usually Grade 1 or 2, while the supraglottic, subglottic and extrinsic are frequently Grades 3 or 4 Metastasis from cordal lesions occurs late, due to the paucity of lymph vessels and low grade malignancy, but metastasis from elsewhere is early on account of the high grade malignancy and rich supply of lymph vessels The prognosis is not dependent on any one factor The initial site of the tumor, its extent on the mucosal surface and the penetration into the underlying tissues must be considered in conjunction with the grading

The methods of treatment for cancer of the larynx are the classical operations of laryngofissure and laryngectomy, special operations with limited indications, fractionated irradiation (Coutard method) and the combination of these The respective techniques of these are an evolution from the contributions of many laryngologists, surgeons and radiologists, and, in the main, are today rather standardized The anesthesia of choice in laryngofissure was local, in laryngectomy, either local or general from sodium pentothal My experience, for what it may be worth, has been that local anesthesia accompanied by the administration of sodium pentothal in laryngectomy is superior to either alone Since the prevention of infection by the prophylactic use of the sulfonamides and antibiotics, the postoperative deaths were practically limited to coronary thrombosis and apoplexy

Intralaryngeal surgery, as now defined, was adapted by Lynch and developed by LeJeune and New It is a special operation with indications limited to a lesion on the mid-third

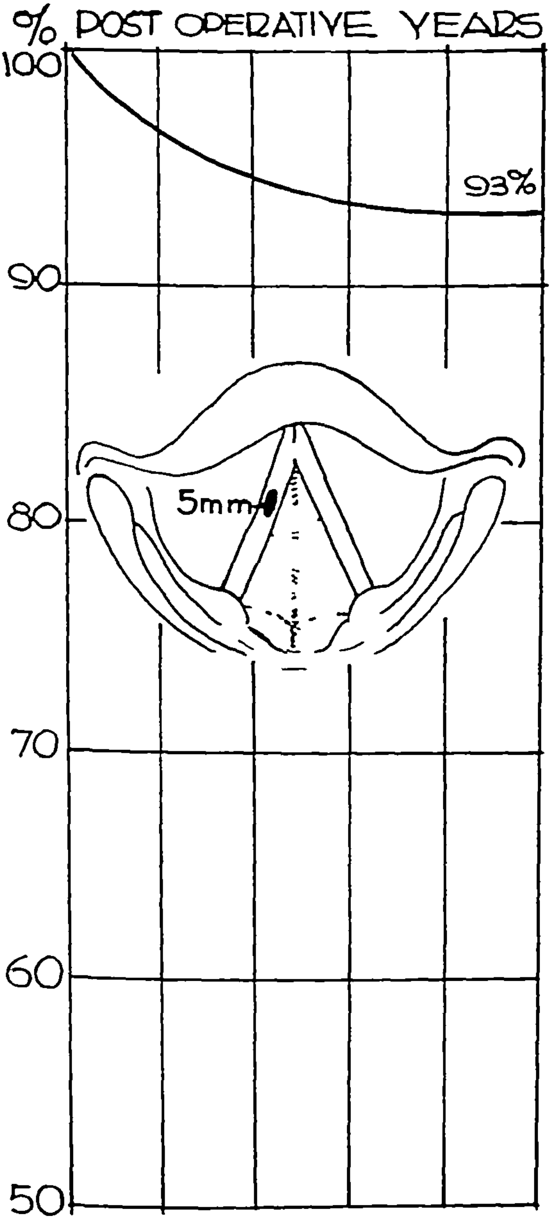


Fig 2 A graph for the survival rate for intralaryngeal surgery (The survival curve in this and following graphs is schematic for the first second third and fourth postoperative years)

such a method For this reason, it may be necessary to repeat a biopsy several times to prove the diagnosis The value of the biopsy in determining the degree of malignancy and of radiosensitivity is at present controversial The consensus now is that Broder's Grades 3 and 4, or anaplastic cancer, have a higher mortality rate than Grades 1 and 2, or the epidermoid, whether treated by surgery or irradiation, that Grades 1 and 2 in a large majority of cases are not radioresistant, and that a radiosensitive cancer is not necessarily radiocurable Cordal cancer is usually Grade 1 or 2, while the supraglottic, subglottic and extrinsic are frequently Grades 3 or 4 Metastasis from cordal lesions occurs late, due to the paucity of lymph vessels and low grade malignancy, but metastasis from elsewhere is early on account of the high grade malignancy and rich supply of lymph vessels The prognosis is not dependent on any one factor The initial site of the tumor, its extent on the mucosal surface and the penetration into the underlying tissues must be considered in conjunction with the grading

The methods of treatment for cancer of the larynx are the classical operations of laryngofissure and laryngectomy, special operations with limited indications, fractionated irradiation (Coutard method) and the combination of these The respective techniques of these are an evolution from the contributions of many laryngologists, surgeons and radiologists, and, in the main, are today rather standardized The anesthesia of choice in laryngofissure was local, in laryngectomy, either local or general from sodium pentothal My experience, for what it may be worth, has been that local anesthesia accompanied by the administration of sodium pentothal in laryngectomy is superior to either alone Since the prevention of infection by the prophylactic use of the sulfonamides and antibiotics, the postoperative deaths were practically limited to coronary thrombosis and apoplexy

Intralaryngeal surgery, as now defined, was adapted by Lynch and developed by LeJeune and New It is a special operation with indications limited to a lesion on the mid-third

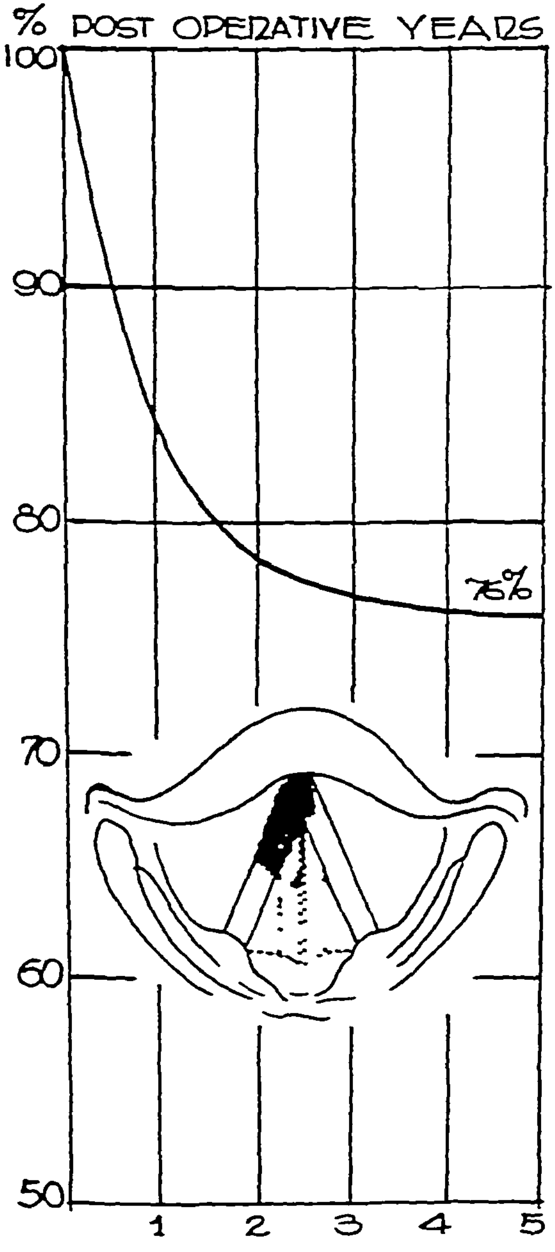


Fig 2 A graph for the survival rate of laryngofissure

of the vocal cord, the motility of which is unimpaired The long axis of the tumor does not exceed 5 mm, with the vocal cord clearly visible around its borders Later, the voice is slightly husky and frequently almost clear The survival rate (see Fig 2) for the five-year period was 93 per cent

The indications for laryngofissure have been a cancer on one vocal cord without involving the arytenoid and, where occurring, an extension across the anterior commissure to the opposite side The contraindications were either fixation of the affected cord, supraglottic and subglottic extensions, penetration through the thyroid cartilage or metastasis The indications for operative technique fell into two groups In the first was the cancer limited to one cord without involving the anterior commissure, the second was that with an extension across the anterior commissure to the opposite cord The surgical technique employed for the first group may be termed cordal laryngofissure, and that for the second, commissure laryngofissure or Jackson's operation The submucosal extension of the neoplasm, as shown by New and Fletcher,[3] is from 5 to 15 mm larger than the surface area, dependent on the grade The rule of 1 cm between the excision and the apparent border of the lesion is nearly always safe, except for Grade 4 The factors of the submerged cancer and of the tendon described by Broyles[24] are important in selecting the type of laryngofissure for lesions approaching the anterior commissure The postoperative deaths were 2 per cent The deaths from causes other than cancer for the five-year period were 10 per cent *The survival rate of laryngofissure for the five-year period* (see Fig 3) was 76 per cent

The tendency for local recurrences and metastasis after laryngofissure increases as the cancer approaches or crosses the anterior commissure Cordal laryngofissure and commissure laryngofissure were reported under the general term of laryngofissure The combined mortality rate after the two operations, as stated above, was 24 per cent What part of this rate followed the one operation or the other? The available evidence on this question was studied and an estimate

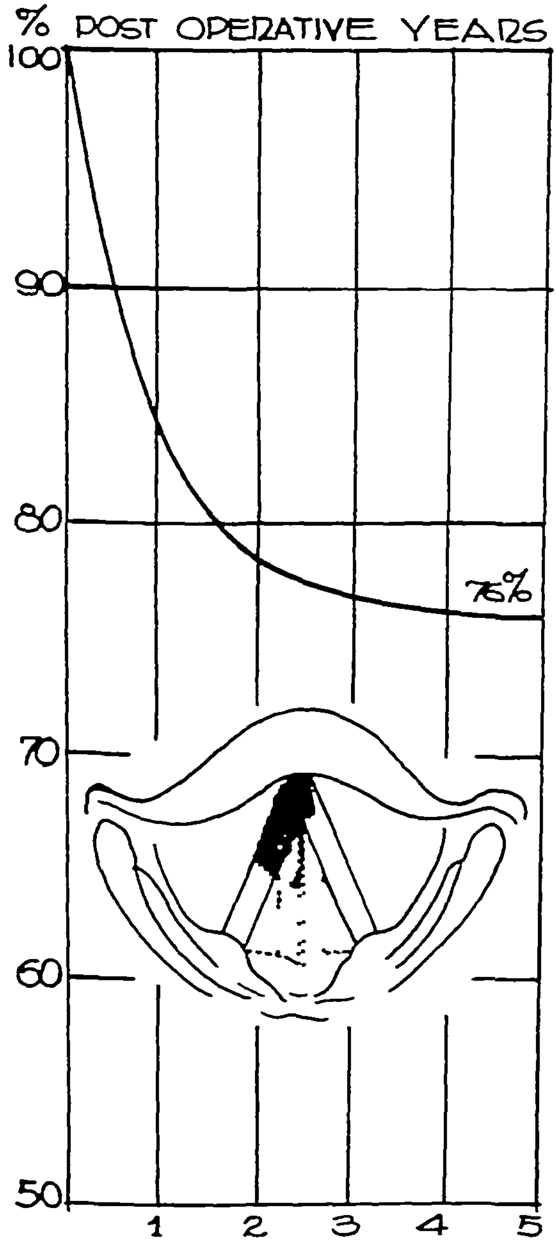


Fig 3 A graph for the survival rate of laryngofissure

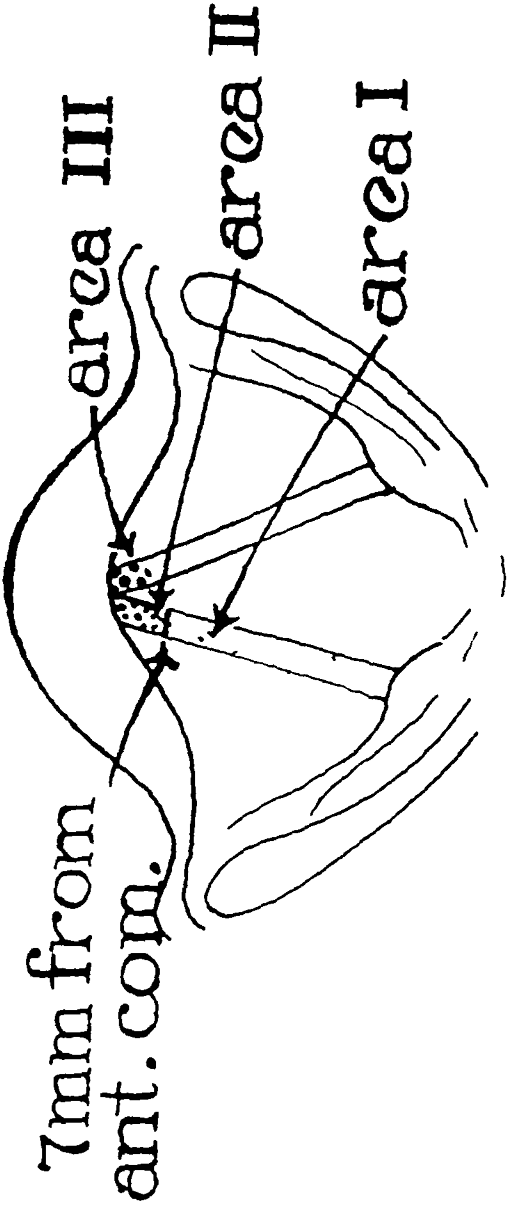


Fig 4 Extent of cancer for cordal laryngofissure Area I for commissure laryngofissure Areas I and II for laryngectomy Areas I II and III

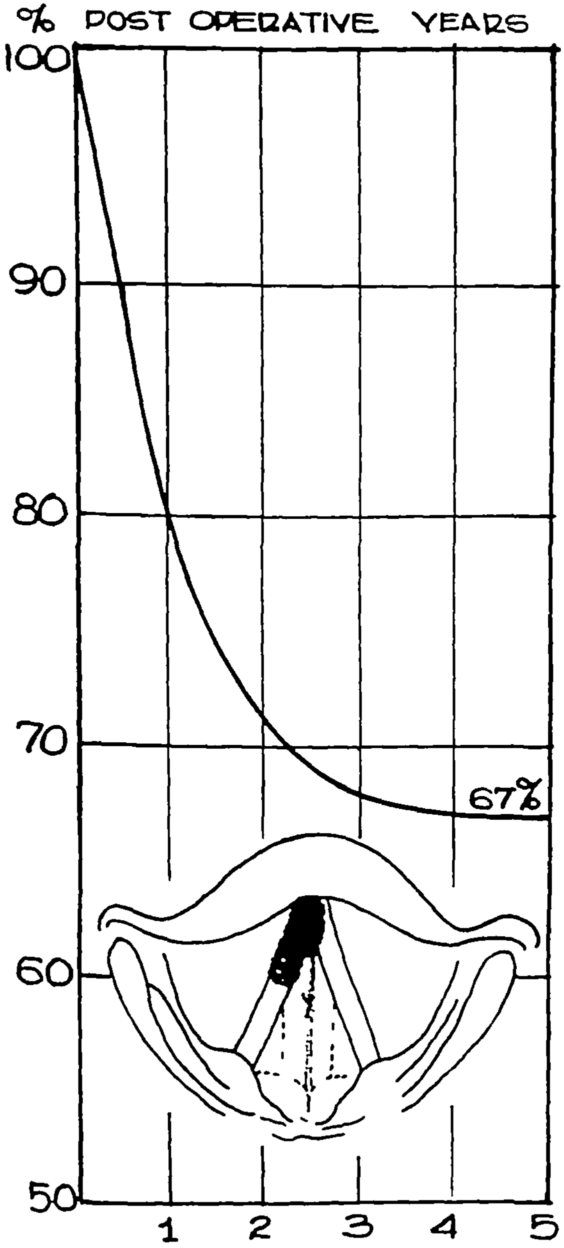


Fig , A graph for the survival rate of irradiation for indications of laryngofissure made that the ratio of the cancer death rate after commissure laryngofissure to that following cordal laryngofissure was two to one In view of this, it is suggested (see Fig 4) that the indications for cordal laryngofissure be a cancer with its posterior border in front of the vocal process of the arytenoid and its apparent anterior border be at least 7 mm from the anterior commissure, that for commissure laryngofissure the lesion reach but not cross the anterior commissure, and that for those neoplasms crossing the anterior commissure a laryngectomy be performed

Fractionated irradiation has been used with increasing frequency during the past decade for the indications of laryngofissure The consensus among radiologists seems to be that radiotherapy is at its best with small superficial cancer, but becomes progressively less effective with increase in size, invasion of deeper tissue and penetration of the thyroid cartilage The relative merits of irradiation and surgery in cordal and commissure laryngofissure are controversial The evidence at present indicates that surgery for a cordal cancer has a higher survival rate and much more voice impairment than irradiation, but sufficient statistical data are not available to make a comparison between surgery and irradiation for commissure cancer Radiotherapy is still experimental and its precise indications have not as yet been statistically established The survival rate during the five-year period following fractionated irradiation for indications of laryngofissure (see Fig 5) was 67 per cent

The respective survival rates of intralaryngeal surgery, laryngofissure and irradiation are shown in Fig 6 Each of these is designed to serve two purposes, to save life and preserve the voice, and each has definite and sharply limited indications These indications have proven to be rigid and not elastic, and can be stretched to preserve the voice only at the expense of life A laryngologist may occasionally break the rules and preserve a voice, but if this is done in a series of cases, his patients pay the hard price of an increased mortality rate

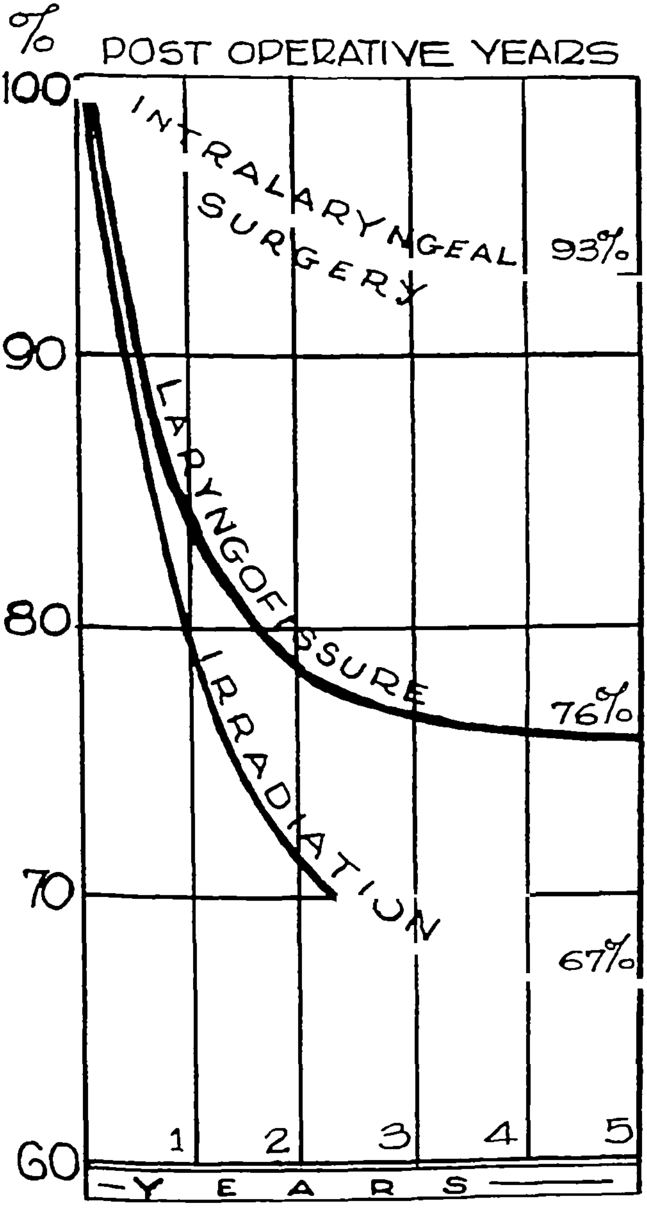


Fig 6 A graph for comparison of respective survival rates

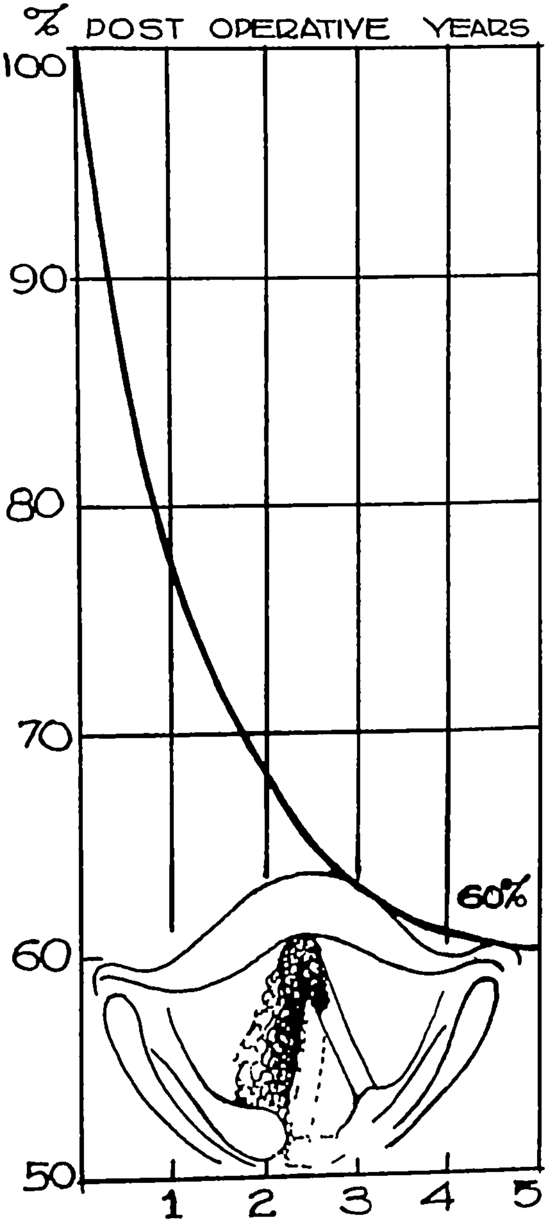


Fig. 7 A graph for survival rate after laryngectomy

The indications for laryngectomy are either carcinoma involving all the superior surface of a vocal cord, fixation of the cord, invasion of the cartilage, extension to the other cord, to the supraglottic, subglottic or extrinsic areas, or metastasis to the regional nodes The consensus is that advanced age of the patient, poor physical condition, original site of neoplasm in supraglottic area with invasion of hypopharynx and metastasis, widespread extension from cordal cancer to extrinsic area, hypopharynx or base of tongue and bilateral metastasis are considered to be contraindications Some laryngologists regard a metastasis to the cervical lymph nodes at the first examination and others consider a large anaplastic neoplasm in the supraglottic area as contraindications for laryngectomy McCall's method for preoperative voice training has received endorsements Postoperative training for developing an esophageal voice was held obligatory No report was made on the technique for closure of the cricopharyngeus muscle to facilitate acquiring an esophageal voice Postoperative deaths were 3 per cent, and deaths from causes other than cancer during the five-year period were 10 per cent The survival rate during the five-year period for laryngectomy (see Fig 7) was 60 per cent It is estimated that postoperative metastasis occurred in about 30 per cent of the laryngectomies without the preoperative indication of their presence Block dissection of the cervical region was considered an essential part of the operation in several reports, as prophylactic postoperative irradiation had proven to be of doubtful value in this group of cases, except probably those with the initial lesion in the supraglottic area

Resection of the thyroid cartilage followed by irradiation as adapted by Arbuckle is a special operation with limited indications The indications for the operation are those cases "ordinarily considered" to be inoperable The normal thyroid cartilage is as tolerant to irradiation as other tissues, but the tolerance is lowered by infection, invasion of cancer, partial resection and previous irradiation The resection of the thyroid cartilage in any event prevents its radionecrosis The survival rate during the five-year period for resection of the thyroid cartilage and irradiation (see Fig 8) was 38 per cent

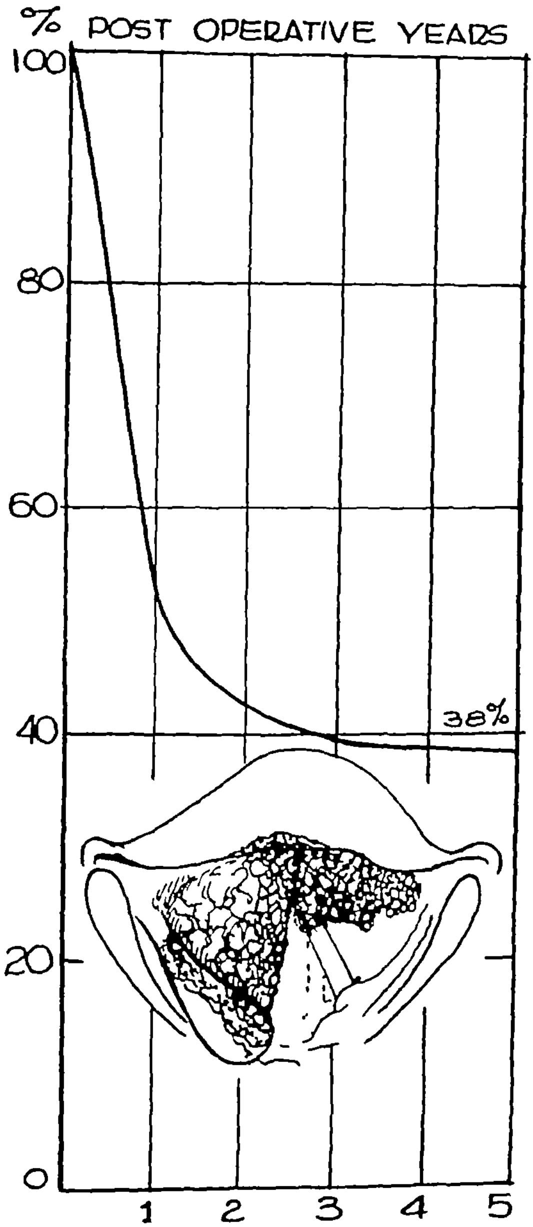


Fig 8 A graph of survival rate for resection of the thyroid cartilage and irradiation

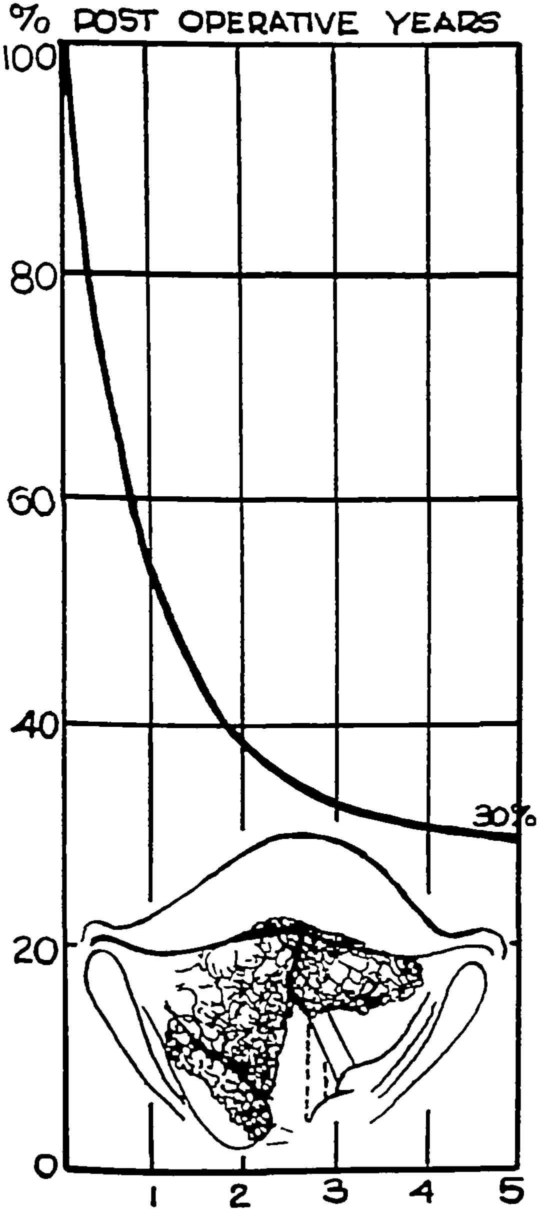


Fig A graph of survival rate after irradiation for salvage therapy

In the reported statistics on fractionated irradiation of the larynx, the inoperable cases were not differentiated from those with indications for laryngectomy, however, it is assumed that all, or nearly all, of the cases were inoperable The consensus among radiologists was that fixation of the vocal cord did not contraindicate radiotherapy Irradiation of the inoperable cases may be classified into two groups, palliative and salvage therapy The unanimous statement of those reporting was that palliative irradiation increased suffering, shortened life and was contraindicated The survival rate during the five-year period for salvage irradiation on inoperable cases (see Fig 9), to the great credit of the radiologists, was 30 per cent Incidentally, Coutard's survival rate during five years for similar cases some 20 years ago was 27 per cent Not included in above was the survival rate during the five-year period after irradiation for extension to the hypopharynx of 7 per cent

Local recurrence was reported more frequently than metastasis after laryngofissure, but after laryngectomy, the ratio was reversed The treatment of local recurrence and metastasis was salvage therapy, and on this basis gave an excellent account of itself The survival rate of salvage therapy by either surgery or irradiation during the five-year period for local recurrences and regional metastases was as follows Laryngofissure, after irradiation, very poor, laryngectomy after irradiation, 50 per cent, laryngectomy after laryngofissure, 39 per cent, block dissection of regional metastasis of those cases treated at second operation after laryngectomy, 44 per cent, irradiation after irradiation for indications of laryngofissure, 32 per cent, irradiation after laryngofissure, 35 per cent, irradiation for local recurrence after laryngectomy, very poor

SUMMARY

1 Cancer of the larynx has wide variations in symptoms, malignancy, treatment and prognosis

2 The biopsy is valuable in differential diagnosis and to define the degree of malignancy, but not in estimating radiosensitivity

3 Broder's Grades 1 and 2 have a higher survival rate than Grades 3 and 4 after both surgery and irradiation

4 Intralaryngeal surgery has the highest survival rate and best functional result due to early diagnosis

5 The present indications for laryngofissure are satisfactory if preservation of a useful voice is considered to be more important than saving life, but if saving life be more important, a revision of the indications is indicated

6 Irradiation has a lower survival rate and much better voice than surgery for the indications of laryngofissure

7 Routine block dissection is indicated with laryngectomy, for approximately 30 per cent of these cases have masked metastases

8 The survival rate of resection of the thyroid cartilage with irradiation on inoperable cases suggests its further trial in salvage therapy

9 These statistics indicate that surgery and irradiation are complementary and not competitive The survival rate of 30 per cent for irradiation in salvage therapy saves many lives otherwise lost

10 The triad for treatment is early diagnosis, saving life and preservation of a useful voice Of these, early diagnosis is the most important, for on it the other two are dependent

REFERENCES

1 Arbuckle, M F Endolaryngeal Surgery Combined with Radiation in Late Laryngeal Cancer *Ann Otol Rhinol and Laryngol* 55 681-689 Sept 46 Also personal communication

2 Bernheimer, L B Carcinoma of the Larynx, *Ann Otol, Rhinol and Laryngol* 49 418-426 June 1940

3 Brunschwig A, and Lindsay J R Further Experiments with Panlaryngectomy for Advanced Carcinoma of the Larynx, *Surg Gynec and Obst* 82 639-642 Nov 1946

In the reported statistics on fractionated irradiation of the larynx, the inoperable cases were not differentiated from those with indications for laryngectomy, however, it is assumed that all, or nearly all, of the cases were inoperable The consensus among radiologists was that fixation of the vocal cord did not contraindicate radiotherapy Irradiation of the inoperable cases may be classified into two groups, palliative and salvage therapy The unanimous statement of those reporting was that palliative irradiation increased suffering, shortened life and was contraindicated The survival rate during the five-year period for salvage irradiation on inoperable cases (see Fig 9), to the great credit of the radiologists, was 30 per cent Incidentally, Coutard's survival rate during five years for similar cases some 20 years ago was 27 per cent Not included in above was the survival rate during the five-year period after irradiation for extension to the hypopharynx of 7 per cent

Local recurrence was reported more frequently than metastasis after laryngofissure, but after laryngectomy, the ratio was reversed The treatment of local recurrence and metastasis was salvage therapy, and on this basis gave an excellent account of itself The survival rate of salvage therapy by either surgery or irradiation during the five-year period for local recurrences and regional metastases was as follows Laryngofissure, after irradiation, very poor, laryngectomy after irradiation, 50 per cent, laryngectomy after laryngofissure, 39 per cent, block dissection of regional metastasis of those cases treated at second operation after laryngectomy, 44 per cent, irradiation after irradiation for indications of laryngofissure, 32 per cent, irradiation after laryngofissure, 35 per cent, irradiation for local recurrence after laryngectomy, very poor

SUMMARY

1 Cancer of the larynx has wide variations in symptoms, malignancy, treatment and prognosis

THE DYNAMICS OF NASAL MUCUS *

G EDWARD TREMBLE, M D ,
Montreal, Canada

One of the most universal complaints of mankind is post-nasal discharge Although disagreeable to the patient, it is also one of the most annoying conditions to treat in nose and throat practice The function of any mucous membrane is to secrete mucus and this should be constantly kept in mind and impressed on the patient

From the time of Hippocrates and for the following 2,000 years, the brain was considered the origin of mucus which reached the nose through the cribriform plate and spread over the nasal membrane Quoting from Wright,[1] "When we realize that the ancients, Hippocrates (460 B C — 375 B C), Galen (130 A D — 200 A D) and their followers knew nothing of the muciparous glands, and, of course, nothing of the function of these microscopic structures, it is easy to understand the absolute mental necessity for them to find some explanation of the origin of the secretions which bathe not only the respiratory tract but the gastrointestinal mucous membranes as well As for the moisture of the lungs, it is natural that they should look for some explanation in the liquids swallowed This lack of knowledge, as well as a mistaken anatomical observation, led them into another error which persisted still longer The cribriform plate of the ethmoid bone (the sieve-like bone) at the top of the respiratory tract was usually seen only in the dried specimen by the ancients, unfamiliar with dissection of the human body The

---

*Read at the Fifty-third Annual Meeting of the American Laryngological Rhinological and Otological Society Inc Chicago Ill April 20 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 24 1949

4 Clerf, L H , Putney, F J , and O'Keeffe, J J Carcinoma of the Larynx *Trans Amer Laryngol , Rhinol and Otol Soc* , pp 482 494, 1948

5 Colledge, L Discussion *Jour Laryngol and Otol* , 60 220 222 May, 1945

6 Coutard, H Present Concept of Treatment of Cancer of Larynx *Radiology*, 34 136 145, Feb , 1940

7 Cunning, D S Advances in Treatment of Cancer of Larynx *Trans Amer Acad Ophth and Otolaryngol* (1943), 48 231 239 Mar Apr , 1944

8 Cutler, M Concentration Radiotherapy of Cancer of the Larynx *Jour A M A* , 124 967 976, Apr 1, 1944

9 Desjardins, A U Figi, F A , and Vaughan L M Roentgen Treatment for Extensive Epithelioma of the Larynx, Results in 139 Cases *Amer Jour Roent and Radium Ther* , 60 29 38, July, 1948

10 Hart, H H , and Hoover, W B Treatment of Carcinoma of the Larynx *N Car Med Jour* , 7 93 98, Jan , 1946

11 Howes, W E and Platau, M Carcinoma of the Larynx *Arch Otolaryngol* , 40 133 138, Aug , 1944

12 Jackson, C L , Brady, J V , Norris, C M , and Maloney, W H Cancer of the Larynx *Jour A M A* , 138 1080 1083, Dec 11, 1948

13 Kernan, J D Treatment of Intrinsic Cancer of the Larynx *N Y State Jour Med* , 48 178 182, Jan 15, 1948

14 LeJeune F E Intralaryngeal Operation for Cancer of the Vocal Cord *Ann Otol , Rhinol and Laryngol* , 55 531 537, Sept , 1946

LeJeune, F E , and Bayou, P J Cancer of Larynx *Ann Otol , Rhinol and Laryngol* , 51 460 470, June, 1942

15 Lentz, M Cancer of Larynx *Jour A M A* , 134 117 121, May 10 1947

16 Lederman, M Treatment of Carcinoma Discussion *Jour Laryngol* and Otol , 60 218 231, May, 1945

17 McCall, J W , and Stover, W G Laryngectomy for Laryngeal Cancer The Laryngoscope, 54 659 676 Dec , 1944

18 Negus, V E Intrinsic Cancer of Larynx Review of a Series of Cases *Proc Roy Soc Med* 40 515, July, 1947

19 New G B , Figi, F A Havens, F Z , and Erich, J B Carcinoma of Larynx, Methods and Results of Treatment *Surg , Gynec and Obst* , 86 623 629, Nov , 1947

20 Orton, H B Cancer of Larynx *Arch Otolaryngol* , 28 153 192 Aug , 1938

21 Schall L A and Ayash, J J Cancer of the Larynx *Ann Otol Rhinol and Laryngol* 57 377-386, June, 1948

22 Tucker G Cancer of Larynx, Diagnosis and Treatment *South Surg* , 10 671 679, Sept 1941

23 New G B and Fletcher E J The Selection of Treatment for Carcinoma of the Larynx *Jour A M A* 99 1754 1758 Nov 19, 1932

24 Broyles, E N Anterior Commissure Tendon (Relation to Cancer) *Ann Otol , Rhinol and Laryngol* 52 342 345, June 1943

1304 Walker Avenue

THE DYNAMICS OF NASAL MUCUS *

G Edward Tremble, M D ,
Montreal, Canada

One of the most universal complaints of mankind is postnasal discharge Although disagreeable to the patient, it is also one of the most annoying conditions to treat in nose and throat practice The function of any mucous membrane is to secrete mucus and this should be constantly kept in mind and impressed on the patient

From the time of Hippocrates and for the following 2,000 years, the brain was considered the origin of mucus which reached the nose through the cribriform plate and spread over the nasal membrane Quoting from Wright,[1] "When we realize that the ancients, Hippocrates (460 B C — 375 B C), Galen (130 A. D — 200 A D) and their followers knew nothing of the muciparous glands, and, of course, nothing of the function of these microscopic structures, it is easy to understand the absolute mental necessity for them to find some explanation of the origin of the secretions which bathe not only the respiratory tract but the gastrointestinal mucous membranes as well As for the moisture of the lungs, it is natural that they should look for some explanation in the liquids swallowed This lack of knowledge, as well as a mistaken anatomical observation, led them into another error which persisted still longer The cribriform plate of the ethmoid bone (the sieve-like bone) at the top of the respiratory tract was usually seen only in the dried specimen by the ancients, unfamiliar with dissection of the human body The

---

*Read at the Fifty-third Annual Meeting of the American Laryngological Rhinological and Otological Society Inc Chicago Ill April 20 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 24 1949

arose that the humors were distilled in the gland-like ments of the cerebral cavities and sifted through the culender plate of the ethmoid to parts below" This conception of the cerebral origin of nasal fluid was also shared by Galen, who lived 500 years after Hippocrates In Galen's description of the nasal passages he said, "the mucus, especially such as is viscid is blown forcibly from the nostrils and is hawked out through the mouth"

People in all walks of life complain of catarrh or postnasal discharge, especially those who spend most of their time indoors Individuals who depend on their voice in their vocation such as public speakers, singers, clergymen, etc, often find it a trying affliction

In determining the cause of this complaint, a detailed history is indispensable The character of the discharge, whether watery or mucoid, the time of day, frequency, previous sinus infections, type of work, whether indoors or outdoors, personal habits, including smoking and alcohol, diet, rest, general health, exercise, mental strain, emotional upsets, etc, should all be carefully noted Many of these conditions can be corrected or avoided, while others, such as environment, are beyond our control

With these facts in mind, let us consider a few points about normal mucus In a healthy nose, mucus is composed of about 2 to 3 per cent mucin, 1 to 2 per cent salts (sodium, calcium and potassium) and about 97 per cent water This proportion differs slightly in individuals and under various climatic conditions For instance, nasal mucus tends to be more viscid in a temperate climate than in a warm, humid atmosphere This is partly due to the drying effect of artificial heat on the nasal mucous membra The active ingredient of mucus is mu a protein com ith glucose It also contains a ver polysaccha ly associated with a protein Mucin their c heir solubilities and degree ty differ lying probably in the prot f the

Nasal mucus differs in its essential characteristics from mucus obtained from any other source Among other things, it has a much greater viscosity than the corresponding gastric mucin Secretion from the nose containing 1 26 per cent protein has a viscosity equivalent to an 8 4 per cent secretion of gastric mucin[3] In other words, nasal mucus is six to seven times as viscid as mucin from the stomach

The whole mucosal lining of the nose from the vestibule to the nasopharynx (just below the level of the Eustachian tube), including the sinuses, secretes mucus to a varying degree The serous and goblet cells of the posterior two-thirds of the septum and lateral wall, particularly in the meatuses in the region of the ostia, form an abundant amount of mucus and drainage in this area is very active The stroma of the inferior turbinates is made up of large cavernous spaces with relatively few glands, while the middle and superior turbinates contain many glands and few cavernous spaces

In general, the direction of the flow of mucus is downward and backward From the frontal sinus, antrum and anterior ethmoid cells mucus is moved along by the cilia into the middle meatus and posteriorly along the lateral wall It moves under the posterior end of the middle turbinate and then downward behind the soft palate and in front of the Eustachian tube just medial to the posterior pillar of the tonsil A little bathes the surface of the tonsil, but the main stream passes down to the pyriform sinus, where it is either coughed up or swallowed From the posterior ethmoid cells mucus streams down from the superior meatus in front of the Eustachian tube and joins the former stream from the anterior group of cells, at about the level of the tube

A smaller stream from the posterior ethmoids goes behind the Eustachian cushion and joins the former combined streams at about the level of the soft palate The stream of mucus from the sphenoid sinus tracks down the anterior wall from the ostium and fans out high up in the nasopharynx and well behind the Eustachian tube to join the other streams just below the level of the soft palate These combined streams of idea arose that the humors were distilled in the gland-like contents of the cerebral cavities and sifted through the cullender plate of the ethmoid to parts below" This conception of the cerebral origin of nasal fluid was also shared by Galen, who lived 500 years after Hippocrates In Galen's description of the nasal passages he said, "the mucus, especially such as is viscid, is blown forcibly from the nostrils and is hawked out through the mouth"

People in all walks of life complain of catarrh or postnasal discharge, especially those who spend most of their time indoors Individuals who depend on their voice in their vocation, such as public speakers, singers, clergymen, etc, often find it a trying affliction

In determining the cause of this complaint, a detailed history is indispensable The character of the discharge, whether watery or mucoid, the time of day, frequency, previous sinus infections, type of work, whether indoors or outdoors, personal habits, including smoking and alcohol, diet, rest, general health, exercise, mental strain, emotional upsets, etc, should all be carefully noted Many of these conditions can be corrected or avoided, while others, such as environment, are beyond our control

With these facts in mind, let us consider a few points about normal mucus In a healthy nose, mucus is composed of about 2 to 3 per cent mucin, 1 to 2 per cent salts (sodium, calcium and potassium) and about 97 per cent water This proportion differs slightly in individuals and under various climatic conditions For instance, nasal mucus tends to be more viscid in a temperate climate than in a warm, humid atmosphere This is partly due to the drying effect of artificial heat on the nasal mucous membrane The active ingredient of mucus is mucin — a protein combined with glucose It also contains a very complex polysaccharid closely associated with a protein Mucins vary in their composition, "their solubilities and degrees of viscosity differ, the difference lying probably in the protein portion of the molecule"[2] also covers the mucosa of the larynx, the trachea, bronchi and even the smallest bronchioles Mucus is colorless, elastic and slightly sticky and can be removed by suction in long strands before it breaks This traveling belt is being constantly replaced and carries away foreign particles, such as dust and organisms which lodge on the surface It is moved by the action of the cilia aided by traction, gravity and the act of swallowing In the active posterior two-thirds of the nose, including the lateral wall and septum, normal mucus moves at the rate of 4 to 6 mm per minute Over the inactive area of the lateral wall and septum, including the anterior ends of the middle and inferior turbinates, normal mucus moves slowly into the meatuses — only a few millimeters per hour In other words, there is a new layer of mucus about once every 10 minutes over the posterior two-thirds of the nose and a new film of mucus about once every hour or two over the anterior one-third These observations, first described by Hilding[5] in 1932, are well known and have stood the test of time Perhaps the manner in which this drainage occurs is not clearly appreciated During the past winter, we have used a phase contrast microscope at McGill University in studying nasal mucous membrane By means of this newer instrument greater detail and definition are obtained than by the standard type of microscope and, as the name implies, better contrast

Pieces of mucous membrane from the medial wall of the middle and inferior turbinates show a definite pattern of ciliary streaming Looking down on the surface and viewing the cilia from above, minute rivulets can be seen which course downward and join others to form larger streams At times these streams are diverted as clumps of cilia move while others rest, but in general the streams tend to converge toward the meatuses

They resemble streams which course down the mountains in the Spring, gaining momentum as they reach the sea Instead of branches, logs and tree trunks — inhaled particles, dust and epithelial debris can easily be seen In the same way this streaming effect is shown when small fragments of antral mucus follow down the posterior pharyngeal wall over the lateral band just medial to the posterior pillar[4] If the mucus is infected, a lateral pharyngitis may result and if the cause is not eliminated a chronic condition is liable to occur This (lateral pharyngitis) further increases the postnasal discharge

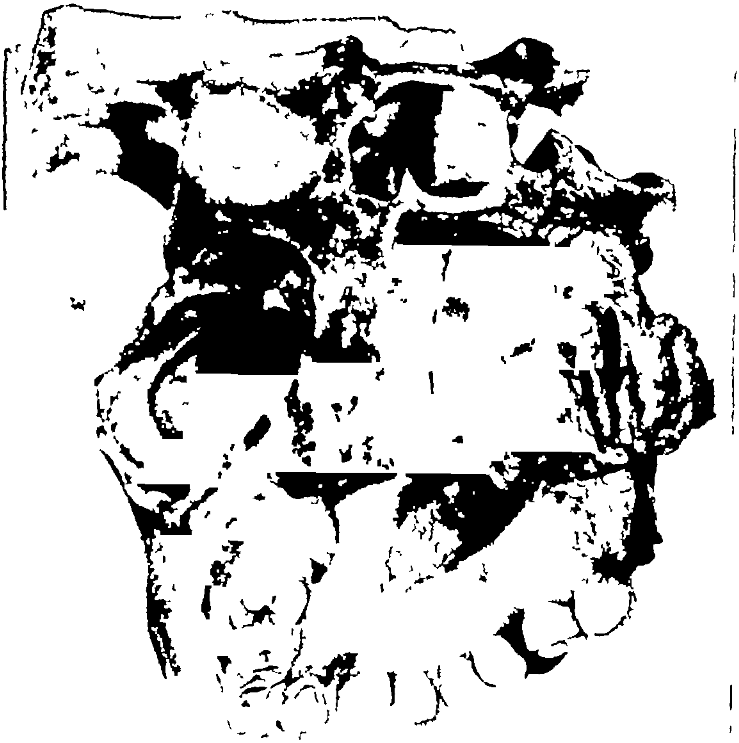


Fig 1 Dried specimen to show the ciliary streams from the sinuses—down in front and behind the Eustachian cushion In this way the streaming avoids the orifice of the tube

In the normal nose a thin sheet of mucus is spread thinly over the whole membranous lining, including the sinuses, and extends downward through the esophagus to the stomach It rative sinusitis "Positive cultures were obtained in 94 5 per cent of the cases and the streptococcus was the predominating organism "[6]

On the other hand, Grove and Farrior[7] found in sinus washings from 200 similar cases that some type of staphylococcus was by far the most frequent organism encountered This applied to the sinus mucous membrane as well In point of fact, it is doubtful whether a bacteriologist would agree to these statements It would be difficult to convince him that in this type of sinusitis 5 5 per cent are sterile, that the method of collecting antral washing is really satisfactory, or that the finding of staphylococcus in such washings is significant

During the past few years it has become a recognized fact that in the normal nose nearly 50 per cent of cases contain staphylococcus in smaller or larger numbers, particularly in the anterior half This is especially true in the presence of obstruction with resultant stagnation of mucus secretion In the healthy nose the posterior half shows fewer bacteria The tendency is clearly to find the presence of bacteria in pathologic conditions an attractive possible explanation, whereas the inevitability of bacteria, at least in small numbers, may center attention on them In many cases of postnasal discharge, it seems highly probable that the bacteria grown from the mucus are saprophytes waiting for the oppprtunity to multiply Very frequently the germs in these discharges are species of micrococci These organisms can be found in dust, in the air and in cultures, just as in the nose, and will sometimes give an unpleasant odor, however, these species do not produce frank suppuration, such as boils or abscesses, and they appear to be totally distinct from their relatives, the staphylococci

Since the cause of the discharge is not due to these organisms, despite their presence in large numbers, their use in vaccines is of doubtful value This is a common experience and yet unquestionably a great proportion of the population have had such bacterial suspensions given them in desperation, furthermore, if the commonly offered explanation of

The pale, water-logged tissue is, of course, due to a glandular disturbance and the membrane shrinks with a cessation of the postnasal mucus at the end of pregnancy

It should be stressed that in the nose the sheet of mucus is one continuous layer which is being constantly replaced, and it moves downward and backward from the nose to the pharynx Part of it is arrested in the region of the larynx, but the main stream of mucus continues down and coats the inner surface of the esophagus

In the lungs the sheet of mucus moves upward from the smallest bronchioles to the larger bronchi and then to the trachea This movement, always toward the glottis, is produced by the action of the cilia It is common knowledge that secretion in the pharynx is much more irritating to the patient than the same amount of secretion in the nose and as a result nervous or highly strung individuals feel it necessary to constantly clear the throat In the vast majority of cases the discharge is harmless When chronic infection is present, the virulence of pathogenic organisms is as a rule attenuated and the acquired immunity developed by the patient tends to render the pathogens innocuous If infected material is swallowed, the hydrochloric acid of the gastric juice is potent enough to destroy most forms of bacteria, however, with the evidence of inflammation present in the form of increased mucus or tissue edema, it is inevitable that the microbes which are present in varying numbers in all respiratory tracts should be suspected What evidence do we have of an etiologic aspect? In purulent sinusitis the relationship is undeniable, but in all other conditions this is anything but the case The mere ability to grow bacteria from the chronic discharges of surfaces open to the air does not in itself prove these bacteria to be responsible They could just as reasonably merely be taking advantage of conditions created by other means The wide variety of organisms described in papers on this subject indeed suggests the latter explanation For example, Hansel in the *Transactions of the American Laryngological, Rhinological and Otological Society, Inc*, for 1948 quotes Kistner's findings in 400 cases of hyperplastic and nonsuppucause little or no discomfort to the patients This area deep in the nose is protected and the active ciliary movement carries the mucus away quickly

Smoking and alcohol in moderation produce a mild congestion and hyperemia which in the early stages does not retard ciliary action In chronic cases fixed tissue changes occur with a permanent dilatation of the blood vessels of the nose, and the mucus becomes thick and sticky The overburdened cilia have difficulty functioning under these conditions and the constant clearing of the throat adds to the patient's discomfort Unless there are pathogenic organisms present in the discharge, and this is infrequent, no harm results

When infection is present as in acute sinusitis, postnasal drainage is a common complaint This is, however, of a temporary nature and tends to disappear when the acute condition subsides

In chronic cases the origin of the discharge should be investigated and if possible eliminated Pus draining posteriorly is a constant source of annoyance and these patients do their best to remove it before it enters and "poisons the system" The ethmoids and sphenoids should be carefully examined and abnormal hypertrophies, especially of the posterior tips of the inferior turbinates, treated

In atrophic rhinitis, there is an increased patency of the nose due to the altered mucous membrane There is a metaplasia from the normal mucosa to a squamous type of lining with isolated islands of ciliated columnar epithelium The excessive dryness causes crusting which at times is odorous and is often accompanied by a purulent discharge posteriorly

The surface of the adenoid is covered with ciliated columnar epithelium which often carries the normal mucus down behind the soft palate in parallel streaks

After adenoidectomy the nasopharynx is covered with squamous epithelium without cilia Unless great care is taken in removal of the adenoid, we often find irregular bands of mucosa are examined under the phase contrast microscope. The currents converge upward toward the ostium when the slide is perpendicular, i.e., against the force of gravity. It is necessary, of course, to moisten the fresh tissue with Ringer-Locke's solution before applying the cover slip, but even when normal saline is used the ciliary beat is well maintained often for hours.

Ciliary movement is of necessity influenced by the consistency of the overlying blanket of mucus. If the proportion of mucin is increased so that the layer of mucus is thick and sticky, movement of the cilia is slowed down (even the addition of one-half of 1 per cent mucin to the normal 3 per cent increases the viscosity of nasal mucus tremendously). On the other hand, where there is an excess of watery mucus containing very little mucin, as in vasomotor rhinitis or hay fever, ciliary action is also impaired. It should be kept in mind that tremendous quantities of thin mucoid secretion flow down in allergic patients without bothering them, but often low grade allergies cause thickening of the mucus with resultant discomfort and postnasal discharge.

In an allergic nose without an excess of aqueous mucus, movement of the cilia on the water-logged tissue is not impaired. It appears to act the same as normal mucous membrane, however, any mechanical obstruction which interferes with normal air currents, causing dryness with stagnation of mucus is a potential source of postnasal discharge. Septal deflections, ridges, spurs, polypi, etc., in the anterior third of the nose are subjected to blasts of inspired air, and the exposed surfaces revert to a squamous type of epithelium without cilia. The drying effect makes the mucus viscid, and it lodges at the back of the nose.

Septal perforations anteriorly, whether due to disease or operative procedures are liable to cause dryness. Cross currents of inspired air increase the consistency of nasal secretions, and they tend to collect posteriorly.

Perforations in the posterior two-thirds of the septum, such as occur occasionally following submucous resection, as a rule, occurs and within two or three days the discharge thickens and the infection is localized

They state that constrictor drops by reducing the engorgement impede the natural defense mechanism In place of drops, localized heat is recommended in the form of an infra-red lamp which aids the normal response and is soothing to the patient

Unfortunately in the nose the increased swelling due to congestion narrows the airways and produces a fullness and stuffiness which adds to the discomfort of the patient In order to clear the head, it is necessary to use vasoconstrictor drops which shrink the membrane and give temporary relief Unless warned by the physician, the patient tends to use drops more frequently and longer than is necessary

It is doubtful whether nasal medication in acute rhinitis or sinusitis shortens the duration of the infection, however, nose drops when used judiciously tend to open the nose and give the patient considerable relief In subacute sinusitis, shrinking agents are helpful as they promote drainage and aid in clearing the nose of purulent discharge When chronic infection is present, attention should be directed to the affected sinus and the use of vasoconstrictor limited to displacement treatment

Emotional upsets are also responsible for many conditions in the nose and throat Nasal obstruction causing pharyngeal dryness, with its resultant postnasal discharge, is a common complaint of highly strung young girls, and in women approaching the menopause When we consider the fact that the ordinary adult swallows on an average of about once a minute, it is easy to appreciate how a person with an unstable nervous system swallows more frequently and develops abnormal feelings in the throat, such as dryness, burning sensations, globus hystericus, etc Blockage of the nose is a frequent symptom in the later months of pregnancy — the turbinates and membrane resemble the appearance seen in hay fever fibrous tissue which form crypts and pockets where mucus tends to lodge After ruling out sinusitis, Prof Hajek, of Vienna, taught his students many years ago to curette the nasopharynx to remove redundant tissue for the relief of postnasal discharge At the time, it seemed a radical form of treatment, but in view of the above facts this appears to be sound advice in well selected cases

Another common reason for a troublesome catarrh is due to nasal medication Vasoconstrictors are the chief offenders, especially when used for a longer period than is necessary According to a Gallop poll survey during the one-week period ending Feb 24, 1942, an estimated total of 23,000,000 persons spent approximately $11,500,000 on medicines to get relief from the common cold This amount was exclusive of medical fees and prescriptions Of this number (23,000,000), about one in every four persons consulted a physician Advertising slogans stress the use of nasal drops to clear the head and ventilate the sinuses, but completely disregard the after-effects due to vasodilatation

The repeated constriction, followed by the compensatory dilatation, in time produces a lack of tone to the nasal vessels A vicious circle occurs as the patient tends to use the drops more frequently because they lose their effectiveness The continued use of saline drops causes an excessive dryness of the mucosa, which in itself produces a postnasal discharge After a time the membrane becomes irritated and swollen, due to the action of the drug Unless the nasal medication is discontinued, the swelling persists Accordingly it would appear to be our duty as rhinologists to impress on patients to use sprays or nose drops sparingly and only in acute and subacute infections

Many eminent rhinologists do not approve of vasoconstrictor drops in acute rhinitis and sinusitis They point out that the normal reaction to infection in the nose, as in other tissues of the body, is redness and swelling due to the increased blood supply, with an exudation of serum A diapedesis of cells rative sinusitis "Positive cultures were obtained in 94 5 per cent of the cases and the streptococcus was the predominating organism "[6]

On the other hand, Grove and Farrior[7] found in sinus washings from 200 similar cases that some type of staphylococcus was by far the most frequent organism encountered This applied to the sinus mucous membrane as well In point of fact, it is doubtful whether a bacteriologist would agree to these statements It would be difficult to convince him that in this type of sinusitis 5 5 per cent are sterile, that the method of collecting antral washing is really satisfactory, or that the finding of staphylococcus in such washings is significant

During the past few years it has become a recognized fact that in the normal nose nearly 50 per cent of cases contain staphylococcus in smaller or larger numbers, particularly in the anterior half This is especially true in the presence of obstruction with resultant stagnation of mucus secretion In the healthy nose the posterior half shows fewer bacteria The tendency is clearly to find the presence of bacteria in pathologic conditions an attractive possible explanation, whereas the inevitability of bacteria, at least in small numbers, may center attention on them In many cases of postnasal discharge, it seems highly probable that the bacteria grown from the mucus are saprophytes waiting for the oppprtunity to multiply Very frequently the germs in these discharges are species of micrococci These organisms can be found in dust, in the air and in cultures, just as in the nose, and will sometimes give an unpleasant odor, however, these species do not produce frank suppuration, such as boils or abscesses, and they appear to be totally distinct from their relatives, the staphylococci

Since the cause of the discharge is not due to these organisms, despite their presence in large numbers, their use in vaccines is of doubtful value This is a common experience and yet unquestionably a great proportion of the population have had such bacterial suspensions given them in desperation, furthermore, if the commonly offered explanation of

The pale, water-logged tissue is, of course, due to a glandular disturbance and the membrane shrinks with a cessation of the postnasal mucus at the end of pregnancy

It should be stressed that in the nose the sheet of mucus is one continuous layer which is being constantly replaced, and it moves downward and backward from the nose to the pharynx Part of it is arrested in the region of the larynx, but the main stream of mucus continues down and coats the inner surface of the esophagus

In the lungs the sheet of mucus moves upward from the smallest bronchioles to the larger bronchi and then to the trachea This movement, always toward the glottis, is produced by the action of the cilia It is common knowledge that secretion in the pharynx is much more irritating to the patient than the same amount of secretion in the nose and as a result nervous or highly strung individuals feel it necessary to constantly clear the throat In the vast majority of cases the discharge is harmless When chronic infection is present, the virulence of pathogenic organisms is as a rule attenuated and the acquired immunity developed by the patient tends to render the pathogens innocuous If infected material is swallowed, the hydrochloric acid of the gastric juice is potent enough to destroy most forms of bacteria, however, with the evidence of inflammation present in the form of increased mucus or tissue edema, it is inevitable that the microbes which are present in varying numbers in all respiratory tracts should be suspected What evidence do we have of an etiologic aspect? In purulent sinusitis the relationship is undeniable, but in all other conditions this is anything but the case The mere ability to grow bacteria from the chronic discharges of surfaces open to the air does not in itself prove these bacteria to be responsible They could just as reasonably merely be taking advantage of conditions created by other means The wide variety of organisms described in papers on this subject indeed suggests the latter explanation For example, Hansel in the *Transactions of the American Laryngological, Rhinological and Otological Society, Inc*, for 1948 quotes Kistner's findings in 400 cases of hyperplastic and nonsuppu-

[illegible] — that of allergy is correct — then multiple [illegible] the giving of vaccines may on occasion sensitize patients [illegible] antigens which previously were not guilty of provoking inflammation but which may now do so In other words it is not admissible to argue that even if a vaccine does not immunize, that it is safe to give it because at least it does no harm All these discussions have so far not taken into account the very common virus agents in the upper respiratory tract, particularly those of the common cold and influenza

There can be no question but that these viruses in a manner not yet understood do permit invasion of the mucous membranes by bacteria, both those normally present on the membranes and those derived from other humans by cross infection In all probability a very high percentage of so-called bacterial invasions, even pneumonia, are initiated by a preliminary virus

Also, there is clear evidence that some bacterial polysaccharides may protect the cells of the body against virus infection The interplay between viruses and bacteria is quite complex and poorly understood at the present time, however, it is easy to understand why it is so important to continue to investigate ways and means of immunizing against these prevalent viruses Immunity against them is so short after one attack that repeated infection is the rule

Secondary bacterial invasion is inevitable and as a result is inclined to be moderately frequent The net result of this over years of time is bound to be a chronic thickening with some dysfunction The solution to this problem would seem to be in prevention from early life This prevention may be in virus immunization or chemotherapy of the subsequent bacterial disease

To sum up, as far as nasal infections are concerned, the object should be to prevent invasion of the mucosa and submucosa with either virus agents or bacteria Such immunization will never be 100 per cent effective and it will be necessary to supplement immunizing procedures with, first, chemotherapy and, finally, with pharmaceuticals designed to offset the action of such microbes which succeed in penetrating and maintaining a foothold in the tissues In this latter respect, it is significant that the allergic basis for these inflammations is supported by the finding that the antihistaminic drugs will reduce the edema in at least 60 per cent of cases of the common cold in the early stages This applies particularly in the acute phase when sneezing and watery discharge are the predominating symptoms Chemotherapy involves an appreciation of the significance of the fact that the mucous membranes under consideration are secreting tissues and that the fluid transfer is, therefore, from the submucosa to the surface, *i e*, from the inside outward, therefore, the topical application of antibiotics requires diffusion against the stream of fluid, which mitigates against effective penetration Under these circumstances, as with lymphatic or glandular infection, systemic therapy is the only route likely to be effective As far as the virus agents are concerned, immunization is not a practical possibility at present and in any case it appears likely to be short lived These facts serve to emphasize the need for chemotherapy of virus diseases The intense research activity in this field has already produced at least two very promising antiviral antibiotics in aureomycin and chloromycetin (aureomycin is formed by a member of the hay bacillus family and chloromycetin by an organism allied to the one which makes streptomycin)

An attempt has been made in this paper to provide a background for understanding the nature of postnasal discharge It is realized that many other contributing factors have been omitted

BIBLIOGRAPHY

1 Wright, Jonathan The Nose and Throat in Medical History St. Louis Mo L. S Matthews and Co p 38

2 Levene, P A. Hexosamines and Mucoproteins Longmans Green and Co 1925

3 Buchmester, Catherine C Nasal Mucin *Ann Otol., Rhinol and Laryngol.,* 45 687 Sept. 1936

4 Yates, A L Methods of Estimating the Activity of the Ciliary Epithelium within the Sinuses *Jour Laryngol and Otol*, 39 554 1924

5 Hilding, A. The Physiology of Drainage of Nasal Mucus The Flow of the Mucus Currents Through the Drainage System of the Nasal Mucosa and Its Relation to Ciliary Activity *Arch Otolaryngol*, 5 92 1932

6 Kistner, F B Histopathology and Bacteriology of Sinusitis with Comments on Postoperative Repair *Arch Otolaryngol*, 13 224 1931

7 Grove, R C, and Farrior, J B Chronic Hyperplastic Sinusitis in Allergic Patients *Jour Allergy*, 11 271 1940

1390 Sherbrooke Street, West

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETING

AT ST LOUIS, SEPT 28, 29, 30

The Fourteenth Annual Meeting, Mississippi Valley Medical Society, will be held at the Jefferson Hotel, St Louis, Sept 28, 29, 30, under the presidency of Dr Alphonse McMahon, associate professor of medicine, St Louis University Over 30 clinical teachers from the leading medical schools will conduct this great postgraduate assembly, whose entire program is planned to appeal to general practitioners There will be some 60 scientific and technical exhibits, noon round table luncheons, etc *No registration fee* will be charged and every ethical physician is cordially invited and urged to attend The entire program and all exhibits will be held on the mezzanine floor of the Jefferson Hotel The American Medical Writers' Association will hold their annual meeting at the hotel on Sept 28 and the Missouri Chapter of the American Academy of General Practice on Sept 30 Programs of all the meetings may be obtained from Harold Swanberg, M D, secretary, M V M S and A M W A, 209-224 W C U Building, Quincy, Ill

THE IMPORTANCE OF SINUSITIS IN ALLERGIC MANIFESTATIONS *

RUSSELL C GROVE, M D (by invitation),
New York, N Y

The importance of chronic sinusitis as an etiologic agent in the cause of allergic manifestations is still a much disputed question I am, therefore, very glad to participate in this meeting of your Section, that I may present a few of the facts as we see them, to prove that any intelligent treatment of these manifestations requires an accurate knowledge of the pathology in the paranasal sinuses and of the basic principles of allergy

After 18 years of close contact with the allergy clinic of the Roosevelt Hospital in New York City, I am convinced that the importance of the disease of the sinuses in the treatment of allergic manifestations is too often under-evaluated by the allergists and also by the otolaryngologists The patient is thus made to suffer unnecessarily by such neglect in diagnosing and treating sinus disease Some allergists are prone to say that the sinus disease as found in the allergic patient is the result of their allergic manifestation such as asthma and not the cause of such manifestation They would throw up their hands and exclaim that these patients have been operated upon time and time again without any cure of the asthma or the sinusitis I think this is a too pessimistic and unfounded attitude, and I hope to be able to clarify a few of the misconceptions and to prove that excellent results can be produced by careful, intelligent handling of disease of the paranasal sinuses

---

*Read at the meeting of the Southern Section American Laryngological Rhinological and Otological Society Inc Washington D C Jan 10 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 9 1949

4 YATES, A L Methods of Estimating the Activity of the Ciliary Epithelium within the Sinuses *Jour Laryngol and Otol* 39 554, 1924

5 HILDING, A The Physiology of Drainage of Nasal Mucus The Flow of the Mucus Currents Through the Drainage System of the Nasal Mucosa and Its Relation to Ciliary Activity *Arch Otolaryngol*, 5 92, 1932

6 KISTNER, F B Histopathology and Bacteriology of Sinusitis with Comments on Postoperative Repair *Arch Otolaryngol*, 13 224, 1931

7 GROVE R C, and FARRIOR, J B Chronic Hyperplastic Sinusitis in Allergic Patients *Jour Allergy*, 11 271, 1940

1390 Sherbrooke Street, West

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETING

AT ST LOUIS, SEPT 28, 29, 30

The Fourteenth Annual Meeting, Mississippi Valley Medical Society, will be held at the Jefferson Hotel, St Louis, Sept 28, 29, 30, under the presidency of Dr Alphonse McMahon, associate professor of medicine, St Louis University Over 30 clinical teachers from the leading medical schools will conduct this great postgraduate assembly, whose entire program is planned to appeal to general practitioners There will be some 60 scientific and technical exhibits, noon round table luncheons, etc *No registration fee* will be charged and every ethical physician is cordially invited and urged to attend The entire program and all exhibits will be held on the mezzanine floor of the Jefferson Hotel The American Medical Writers' Association will hold their annual meeting at the hotel on Sept 28 and the Missouri Chapter of the American Academy of General Practice on Sept 30 Programs of all the meetings may be obtained from Harold Swanberg, M D, secretary, M V M S and A M W A, 209-224 W C U Building, Quincy, Ill

THE IMPORTANCE OF SINUSITIS IN ALLERGIC MANIFESTATIONS [*]

RUSSELL C GROVE, M D (by invitation),
New York, N Y

The importance of chronic sinusitis as an etiologic agent in the cause of allergic manifestations is still a much disputed question I am, therefore, very glad to participate in this meeting of your Section, that I may present a few of the facts as we see them, to prove that any intelligent treatment of these manifestations requires an accurate knowledge of the pathology in the paranasal sinuses and of the basic principles of allergy

After 18 years of close contact with the allergy clinic of the Roosevelt Hospital in New York City, I am convinced that the importance of the disease of the sinuses in the treatment of allergic manifestations is too often under-evaluated by the allergists and also by the otolaryngologists The patient is thus made to suffer unnecessarily by such neglect in diagnosing and treating sinus disease Some allergists are prone to say that the sinus disease as found in the allergic patient is the result of their allergic manifestation such as asthma and not the cause of such manifestation They would throw up their hands and exclaim that these patients have been operated upon time and time again without any cure of the asthma or the sinusitis I think this is a too pessimistic and unfounded attitude, and I hope to be able to clarify a few of the misconceptions and to prove that excellent results can be produced by careful, intelligent handling of disease of the paranasal sinuses

---

[*] Read at the meeting of the Southern Section American Laryngological Rhinological and Otological Society Inc Washington D C Jan 10 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 9 1949

It is necessary in the first place to establish the fact that there is a definite pathology in the sinuses, and in the second place to decide if this pathology is an etiologic factor in the production of the allergic symptoms I agree that quite often these patients are operated upon without sufficient pathology being present in the sinuses and, therefore, no relief is produced Many patients are also operated upon in whom this pathology when present is not influencing their allergic symptoms, and likewise the result is bad For instance, a patient whose asthma is due to pollens, house dust or animal danders, or a patient whose urticaria is due to the ingestion of certain foods or to a contact exposure will not be helped by any operation upon the sinuses On the other hand, if the patient's asthma or urticaria is precipitated at certain times, or is made worse by upper respiratory infections involving the sinuses, then such an operation will be of value

Thus, to discuss the topic in hand intelligently, it is necessary to remember these facts, namely, that certain allergic manifestations are of the atopic or skin-sensitive type, while others are of the nonsensitive or infective type The first group is diagnosed by the skin tests, whether by the intradermal or scratch method, the patch test and the use of elimination diets The second group is usually negative on skin testing and the presence of pathology in the upper respiratory tract as well as the influence of such infection on the allergic symptoms can be demonstrated We might add that in addition to the skin-sensitive and the infective types, we may have the combined type, that is, the patient may show positive skin reactions and also the presence and influence of foci of infections If these three dicta are kept in mind, I think one is in a better position to evaluate the importance of otolaryngological pathology in the treatment of allergic disease

According to Adam, Herck, of Freiberg, in 1844, first recognized the importance of sinus disease as a cause of asthma, however, it was not until 1872 that an Italian, Voltolini, showed the effect of sinus surgery on asthma when he reported 11 cases of asthma in which relief followed polypectomy Since that time, the frequency and importance of sinusitis in asthma has been argued pro and con and its treatment has varied from conservative to radical surgery, although many physicians still advocate no surgery at all

In order to express our belief in the importance of sinusitis as a cause of asthma and the necessity for the treatment and if possible the elimination of the sinusitis, I shall discuss the incidence of sinus disease in the asthmatic patients, the pathology and the bacteriology of the sinus membranes, the diagnosis of the sinusitis and the operative results

The literature on the frequency of sinus disease in asthma patients shows a wide variation This is due in large part to the method of diagnosis, that is, whether it is based on rhinoscopy alone or Roentgenograms Gottlieb found sinusitis present in only 26 per cent of 117 patients with asthma Dundas-Grant stated that 63 per cent of 107 cases of asthma had sinusitis Chobot, in a group of 84 children up to 15 years of age, found X-ray evidence of sinus disease in 67 per cent of the patients Kern and Schenck, after a careful study of 400 cases of asthma, found that 70 per cent had clinical sinusitis and 87 5 per cent showed X-ray evidence of disease More recently, Kelley reported that 89 per cent of 100 cases of asthma had rhinologic and X-ray evidence of sinusitis

In a comprehensive study in our clinic, based on 688 cases of asthma, Cooke found sinus disease to be the cause in 45 per cent of all patients between the ages of 10 and 80 years Cooke, in this group of 688 cases, found that there was a positive antecedent history of allergy in 45 per cent of the entire infective group and 52 per cent of the atopic ones Sixty-six per cent of 195 cases of asthma gave an antecedent history of asthma and of other allergic manifestations in 34 per cent Clarke, Donnally and Coca, however, quoted 80 per cent with a positive antecedent history Kern and Schenck after a survey of 345 cases of nasal polyposis came to the conclusion that an allergic history or other allergic manifestations are always present

The pathology of the nasal and sinus membranes in asthmatic patients is well recognized In our experience almost 100 per cent of the pathology is of the hyperplastic or thickened membrane type as contrasted with the suppurative type There may be exacerbations of infection and pus appears in the washings and neutrophiles predominate Polyposis occurred in from 30 to 35 per cent of our cases, but more recent studies have shown this percentage to be lower particularly in patients who had not been operated upon previously Kelley in his study reported 26 per cent of 89 cases had nasal polyps

We have also had these membranes cultured, and found that 80 per cent showed positive cultures of one or more organisms When we compared the organisms obtained from 87 membranes with those grown from previous washings of the antra, we were surprised to find that 43 7 per cent were different from any recovered preoperatively, including the negative ones, and I would like to state here that we do not believe that the simple washing of an antrum and finding it clear and the report of a negative culture of the return flow indicates a normal or noninfective sinus

The tissues removed from the sinuses were stained and in over 85 per cent bacteria were demonstrated very definitely, while the remaining 15 per cent were too questionable to be considered positive

Kistner, in 1931, studied 400 sinus membranes culturally and found streptococci present in 94 5 per cent of the cases Rosenow, of the Mayo Clinic, checked some of his specimens microscopically and agreed that the membranes were infected Hansel, Piness and Miller, Ashley and Frick, and Balmer and others believed that organisms in the membranes are secondary invaders, but from our own studies we cannot accept this explanation

The question arises, how is one going to diagnose this type of sinusitis in allergic patients? The answer is, by careful clinical laboratory and X-ray examinations The history of frequent colds, stuffiness, nasal discharge anteriorly or posteriorly, sneezing and headache is important, but frequently all of these symptoms are absent The nasal examination should include anterior rhinoscopy followed by the use of the nasopharyngoscope The nasopharyngoscope is very important, as otherwise discharge from the antrum, posterior ethmoids and sphenoids and small polyps posteriorly may be overlooked Transillumination should be done, but if this reveals nothing abnormal, the examination is not complete Good Roentgenograms are very important, especially for diagnosing polyps and cysts of the antrum

TABLE 1 RESULTS OF SURGERY ON THE SINUSES IN 200 CASES OF ASTHMA.

Postoperative Years	Cases	Improvement		
		—	+ —	+ — —
½ 1	18	8	8	2
1 2	23	9	8	6
2 3	18	7	6	5
3-4	24	10	9	5
4-5	17	3	9	5
5-6	11	5	1	5
6-7	7	4	3	2
7 8	8	2	6	8
8 9	17	2	4	3
9 10	22	6	5	1
10 11	9	1	0	4
11 12	16	1	7	2
12 13	15	3	3	2
13 14	8	1	2	3
14-15	6	0	2	4
15-16	6	0	3	3
16-17	2	0	1	1
Total	200	62	77	61
			138 or 69%	

—Indicates slight or no improvement.
——Indicates definite improvement.
———No asthma or a rare attack.

In recent years, we have been making more use of radio-opaque solutions in the diagnosis of the type of sinusitis found in our allergic patients The plain films may often show only slight pathological changes in the sinuses, especially the antrum These changes often may not seem sufficient to justify an operation In the infective type of allergic manifestations, where it is necessary to eliminate all infection, we have resorted to the injection of radio-opaque solutions such as lipiodol into the sinuses It seems to us that in these cases the iodized oil, being so opaque, often obscured polyps or cysts if they were in such a position as to cause little defect in the marginal outlines of the sinuses It was not until 1938 that we discovered a new substance for diagnosing such cases We

TABLE 2 RESULTS OF SURGERY ON THE SINUSES IN 200 CASES OF ASTHMA BASED ON THE COMPLETENESS OF REMOVAL OF ALL DISEASED TISSUE

Postoperative Years	Complete Surgery			Incomplete Surgery		
	+	++	+++	+	++	+++
½ 1	4	5	1	4	3	0
1 2	6	7	5	2	2	2
2 3	0	6	3	7	0	2
3 4	5	7	3	6	1	2
4 5	3	9	5	0	1	0
5 6	3	0	4	3	0	1
6 7	3	2	1	3	0	1
7 8	0	6	5	2	0	2
8 9	0	4	3	2	0	0
9 10	2	5	1	4	0	0
10 11	1	0	3	0	0	1
11 12	1	6	2	0	1	0
12 13	1	3	1	2	0	0
13 14	1	2	3	0	0	0
14 15	0	2	4	0	0	0
15 16	0	3	3	0	0	0
16 17	0	1	1	0	0	0
Total	30	68	48	35	8	11
		116 or 79 9%			19 or 35 2%	

had a patient who was sensitive to iodine, so we decided to try 25 per cent colloidal solution of thorium dioxide We were impressed with the delicacy, if one may call it such, of the shadows on the X-ray films The solution, when diluted one or two times, seemed to produce a less dense shadow and the margins and backgrounds of the sinus were more clearly delineated Since that time, we have injected over 500 sinuses without any untoward reactions

TABLE 3 RESULTS OF SURGERY ON THE SINUSES IN 200 CASES OF ASTHMA BASED ON THE TYPE OF ASTHMA

Postoperative Years	Infective Type			Combined Type		
	+	++	+++	+	++	+++
½ 1	5	4	0	3	4	2
1 2	8	3	2	1	5	4
2 3	3	5	3	4	1	2
3-4	4	4	2	6	5	3
4 5	3	1	1	0	8	4
5 6	4	1	1	1	0	4
6 7	3	2	1	1	1	1
7 8	2	5	2	0	1	6
8 9	1	3	0	1	1	3
9 10	5	4	0	1	1	1
10 11	1	0	0	0	0	4
11 12	0	4	2	1	3	0
12 13	1	2	1	2	1	1
13 14	1	1	1	0	1	2
14 15	0	2	3	0	0	1
15 16	0	2	2	0	1	1
16 17	0	1	1	0	0	0
Total	41	44	22	21	33	39
		66 or 61%			72 or 77 4%	

If the X-rays show evidence of the sinusitis, we usually do a lavage of the antrum or sphenoid sinuses The return flow is centrifuged and examined microscopically for evidence of pus cells and eosinophiles We usually make cultures also for possible use as vaccines

Once the diagnosis of sinusitis is made, we must decide upon the proper form of treatment. If polyps are present in the ethmoids or sphenoids, they should be removed if the asthmatic condition justifies such a procedure. By removal of the polyp we do not mean a simple polypectomy but an exenteration of the ethmoids or sphenoids. Polyps, cysts and extensive thickening of the membrane of the antra require a Caldwell-Luc operation. We have not been satisfied with the results obtained by doing simple antrostomies or "window" resections. In conjunction with these operations submucous resections and trimming the turbinates are done for the effect upon the sinus infection and not as a direct benefit to the asthmatic condition. The removal of infected adenoids, tonsils and teeth is also important when indicated.

Regardless of the degree of sinusitis, a complete allergic testing and treatment is necessary. A large number of recurrent polyp cases can be cured if the dust or other inhalant allergens are treated before and after the operation. Blood examinations including Wassermann, kidney and chest examinations, including X-rays and sputum for tuberculosis, molds and spirochetes are usually indicated. Determination of increased sedimentation rate is often important in studying these infective cases. Recently the question of vitamin deficiency has been emphasized, and in certain cases vitamin assay is necessary.

In discussing the effects of sinus surgery upon asthma, I would like to refer first to the frequency of the various sinuses involved and the operations performed. The antrum is the most frequently involved and the ethmoids second. The frontal sinus is the least often involved. The most frequent operation is the exenteration of the ethmoids, with the Caldwell-Luc operation on the antrum being next in order. The external operation on the frontal sinuses is rarely necessary. Usually after performing an exenteration of the ethmoids and a Caldwell-Luc operation, the frontal sinus is provided with better drainage and ventilation through the frontal duct and exacerbations of infection are infrequent.

It seems to us that the importance of sinus disease as a primary cause of asthma is well shown by the effects of sinus surgery in asthmatic patients even after many years' duration Unfortunately, the results as recorded in the literature are not too encouraging

Heatley and Crowe in a series of 62 operative cases found 53 improved, but "only one case was enthusiastic enough to describe himself as cured" after three years Rackeman and Tobey studied 91 cases of asthma whose sinusitis was treated surgically and reported 14 per cent cured, 46 per cent improved, 31 per cent unimproved, and 9 per cent died Weille stated that in his group of 40 patients, whom he operated upon for sinusitis, only 50 per cent had a chance for relatively long confirmed improvement in their asthma

Schenck and Kern, Vaughan and Warner, and McGregor reported even less favorable results It seems to us, however, that in many of these reports it is not made clear as to the importance of associated sensitizations, the extent of the sinus pathology, and the completeness of the removal of the pathology from all of the sinuses

Since 1935 we have made six very complete studies of the results of our sinus surgery in asthmatic patients The first study, reported in 1935, included 120 cases, the longest of which had been followed for three and one-half years In 1947, I reported on 200 patients with a postoperative period of observation of 17 years It was very interesting that the percentage of improvement in the asthma was almost the same in the six groups Any intelligent analysis of the effect of sinus surgery on asthma must include accurate information as to the type of asthma, that is, whether due to infection alone, infection combined with sensitization or to sensitizations alone In the second place, it is necessary to know how many sinuses in the infective type of asthma are involved with disease and how completely was this pathology removed by operation In other words, if the ethmoids and antrum are involved an operation on the antrum or ethmoids alone will not produce a good result Likewise if both antra are diseased and only one is operated upon there is no reason for thinking the patient will be cured Complete elimination of pathology as far as possible is absolutely necessary For this reason we do not believe that the simple removal of a polyp or polyps with the snare or making of a window in an antrum are sufficient operative procedures to cure asthma I have three slides analyzing our last study of 200 asthmatic patients whose sinus disease was treated surgically They have been followed postoperatively for one-half to 17 years They have all been studied as to the type of asthma and the completeness of the surgical procedures in removing the pathology We are not reporting any results under a six months' follow-up because these results are too transitory, the effect of the anesthetic often produces a temporary relief from the asthma, while the removal of the infected sinus membranes may produce an immediate exacerbation of the asthmatic symptoms

The infective group comprises 107 cases and the combined group, that is, infestion plus sensitizations, 93 cases The groups in whom sinus surgery was considered complete had 146 cases and the incomplete group 54 cases

The improvement in the total group was 69 per cent This is about the same figures reported in our previous surveys In this group, however, we are including all of our clinic patients who are more difficult to treat as thoroughly or as completely as private patients

Several points should be stressed in this analysis In the first place, it is quite obvious that there is a striking difference in the group who were operated as completely as possible and the group treated incompletely, 79 9 per cent improvement as compared with 35 3 per cent It is also observable that in the completely operated group the improvement increased with the duration of the postoperative period of time We believe that this is explained by the fact that there are secondary foci of infection in the cervical and bronchial lymphatic glands and the bronchial mucosa and that these secondary foci heal slowly after the removal of the primary focus It is possible that the patients who did well immediately after operation never had these secondary foci, while, on the other hand, the patients who did not do well, even with increasing time, lacked the capacity to heal these foci

In 1941, I reported in the study of 200 cases of asthma, who were operated upon, that 27 of the patients had a "window" resection or an antrostomy with only 40 per cent improvement in their asthma On the other hand, 19 patients who had had previous antrostomies were operated upon radically and a 79 per cent improvement was produced Ninety-four cases who had primary radical antrum operations showed a 75 5 per cent improvement in their asthma It seems that these figures prove that the antrostomy operation does not eliminate the infection in the membranes completely We have noticed after the antrostomy that frequently the "window" becomes blocked by polypi, or that it does not function any more, and that upper respiratory infections are more frequent, which necessitates more local treatment of the sinuses and, of course, produce exacerbation of the asthma The patients who have had the necessary surgery completed frequently go through the upper respiratory infections without any or only a slight flare-up of their asthmatic symptoms

Referring again to our analysis of the 200 cases, we find that the results are better in the combined type of asthma as compared with the infective type In this group the infection is often a secondary factor, and, in addition, all of these patients are treated with injections of the indicated allergens as well as by the proper elimination of the allergens when possible Injections of house dust have not only helped to maintain prolonged freedom from asthma but have in many cases helped to prevent the recurrence of nasal polyps Practically all of our patients of both groups were treated with autogenous vaccines made from cultures of the infected sinus membranes removed at operation In addition, all extranasal infections such as molds (fungi), spirochetes and tuberculosis should be treated, infected teeth, tonsils and adenoids should be removed A few of the patients who improved but moderately after a complete sinus operation showed striking improvement after having an ovarian or uterine tumor or an infected gall bladder or appendix removed

I made an additional study of these patients as to the age of onset of their asthma, the duration of the asthma and the age at operation It seems from these studies that we can say that a patient whose asthma began between 21 and 35 years of age, has been present not longer than 10 years, and preferably less than five years, and the patient is between 31 and 50 years of age at the time of operation has the best chance to obtain a satisfactory result

SUMMARY

The incidence of sinus disease in asthmatic patients, the type of pathology, the bacteriology of the diseased membranes, and the results of sinus surgery in asthmatic patients are discussed to show that sinus disease is a very important cause of asthma Any thorough and intelligent treatment of asthma requires that careful consideration be given to pathologic condition in the paranasal sinuses Special diagnostic studies such as the use of the nasopharyngoscope and the injection of radio-opaque solutions into the antrum are necessary in all doubtful cases of disease of the sinuses

In order to obtain accurate information as to the effect of sinus surgery on asthma it is necessary *1* to study the etiologic factors causing the asthma, that is, whether infective alone or infective associated with demonstrable skin-sensitizations, and *2* to analyze the type of sinus surgery, as to whether the diseased tissue in the sinuses is removed completely or incompletely

Immediate improvement should not be expected and follow-up studies have shown that with increasing postoperative periods of time steadily improving results are obtained We believe that this is due to the gradual elimination of the secondary infections in the cervical and bronchial lymphatic glands and the bronchial mucosa It is possible that the patients who do poorly lack this capacity to overcome their secondary foci of infection

Surgical procedures on the sinuses cannot be expected to produce improvement of the asthmatic condition if extranasal infections and associated allergies of the skin-sensitive type are not treated properly Autogenous vaccines are considered important in the treatment of the infective cases

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Home Study Courses in the basic sciences related to ophthalmology and otolaryngology, offered as a part of the educational program of the American Academy of Ophthalmology and Otolaryngology, will begin on Sept 1 and continue for a period of 10 months Registrations must be completed before Aug 15 Detailed information and application forms may be secured from Dr William L Benedict, the executive secretary of the Academy, 100 First Avenue Building, Rochester, Minn

LOCAL RESECTION OF CARCINOMA OF THE RIGHT MAIN BRONCHUS *

EDWIN N BROYLES, M D, and
WILLIAM F RIENHOFF, JR, M D (by invitation),
Baltimore, Md

The diagnosis and treatment of lung tumors is a brilliant story and tribute to all branches of medicine and surgery Pneumonectomy, lobectomy and segmental resection require not skilled surgery alone but also expert X-ray, bronchoscopic and medical diagnosis and treatment Following the publication of the results of surgical treatment of lung tumors both the medical profession and the laity are seeking this expert aid earlier, with definite improvement in prognosis The early diagnosis of tumors advantageously located (trachea and large bronchi) may warrant the local removal of the tumor, either through the bronchoscope or by surgical resection without sacrificing lung tissue

The case reported here represents such a combination of favorable development

Mrs A S, No 466302, white female aged 22 entered Johns Hopkins Hospital on June 29 1948, complaining of hemoptysis Her present illness began in December 1947 with an insidious onset of fever, vague aching in right chest cough and expectoration of blood She was sent to a local hospital where she was given penicillin She recovered from the acute condition but had a persistent wheeze cough occasional dyspnea and hemoptysis Six weeks ago she became very dyspneic She was sent to a nearby city where she was bronchoscoped on two occasions Tissue removed was diagnosed carcinoma Since the bronchoscopic examinations she has been free of cough wheezing and dyspnea Because of the diagnosis her local doctor requested her to consult Dr Rienhoff

---

*Read at the meeting of the Southern Section American Laryngological Rhinological and Otological Society Washington D C Jan 10 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication March 14 1949

She was again bronchoscoped on June 30 1948 and a small red velvety tumor about the size of a raspberry was seen in the right main bronchus 1 cm. from the carina Tissue was again removed and diagnosed lung carcinoma (S P 48 2480) Because of the small size of the tumor and its location it was thought an attempt should be made to resect the tumor instead of resecting the right lung and bronchus up to the carina On July 1 1948 Dr Rienhoff through a right chest incision exposed the trachea and the right bronchus after ligating and dividing the azagos vein this permitted good exposure also of the tracheal bifurcation and the first portion of the left main bronchus The lymph glands in the region of the bifurcation of the trachea were not involved and the outer wall of the right bronchus had not been penetrated by the growth. An incision was made in the lower trachea and right bronchus which exposed the region of the carina and location of the growth With an elliptical incision the growth along with the bronchial wall was removed and the region burned lightly with an electric cautery Interrupted silk sutures closed both defects (incision and resection) and the chest wall was closed in the usual manner Section of the resected growth (S P 482496) was diagnosed bronchial adenoma The postoperative course of the patient required aspiration of fluid from the right chest on several occasions and there was some fever Because of the first diagnosis on July 12 1948 the patient was bronchoscoped and 1200 mc of radon placed over the site of the resected tumor for one minute At this time there was no constriction of the bronchus and no evidence of tumor These have been the findings on later bronchoscopic examinations done in August, October and December 1948 The patient has remained well There has been no hemoptysis no dyspnea and from examination no evidence of recurrence of the growth

Slides of the first tissue removed were obtained also slides of our first biopsy were re-examined with the diagnosis still remaining lung carcinoma It would seem then that the epithelium covering the growth had undergone what appeared to be a malignant change whereas the deeper section of the excised tumor was an adenoma

With earlier diagnosis, it is hoped that more small tumors of the trachea and larger bronchi may be completely and successfully extirpated

NATURAL ABSENCE OF PART OF THE BONY WALL OF THE FACIAL CANAL*

STACY R GUILD, Ph D,
Baltimore, Md

Injury of the facial nerve is a dreaded complication of otologic surgery The course of the facial nerve through the temporal bone is, therefore, always emphasized in teaching the anatomy of the region to house officers on otologic services Precautions to safeguard the nerve during operations are stressed, and young staff members are repeatedly warned that it may be injured even by the pressure of dressings on an accidentally exposed segment

It seems not to be generally realized, however, that without disease or operation a part of the facial nerve may be devoid of protection by bone In fact, a survey of textbooks and handbooks of anatomy and of surgery commonly used by students failed to reveal any mention of an absence of part of the osseous wall of the facial canal (Fallopian canal or aqueduct of the older terminologies) not due to some disease process The books give the impression, rather, that the facial nerve always is covered by bone throughout its course in the temporal bone except when necrosis or erosion of the osseous wall of the canal has been caused by disease

Experienced otologists, especially those who have examined many sets of histologic sections of human temporal bones, know from observation that the facial nerve in uninfected ears is not always entirely covered by bone, and that a gap in the continuity of the osseous wall may be present in any part of the facial canal Despite their own awareness of the clinical implications of the observed anatomic condition, they often find it difficult to make assistants fully realize the serious possibilities Part of the difficulty arises from the absence of pictorial illustrations in the available literature The pri-

---

*From the Otological Research Laboratory The Johns Hopkins University School of Medicine

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 1 1949

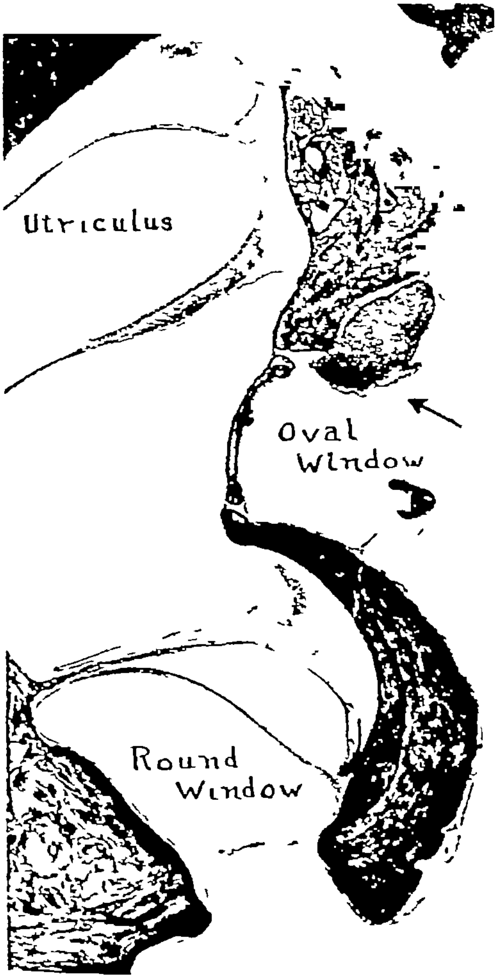


Fig 1 Photomicrograph at low magnification of part of a section of the left temporal bone of a 5-year old man The osseous wall of the facial canal above the oval window is incomplete in this ear so that part of the facial nerve is covered only by fibrous tissue and epithelium Note that the mucosa of the middle ear is normal There was no history of ear disease and the hearing was normal

mary purpose of the present communication is, therefore, to provide visual evidence that can be used in teaching

Three examples of gaps in the continuity of the bony wall of the facial canal are shown in the accompanying photomicrographs One of the gaps shown is in the part of the facial canal that passes above the oval window (see Fig 1), one is in the part of the canal just below the prominence of the horizontal semicircular canal (see Fig 2), and one is in the so-called descending, or mastoid, part of the canal (see Figs 3 and 4) The low magnifications used for the pictures permit, in each instance, easy recognition of the relations of the facial nerve to other structures of surgical importance

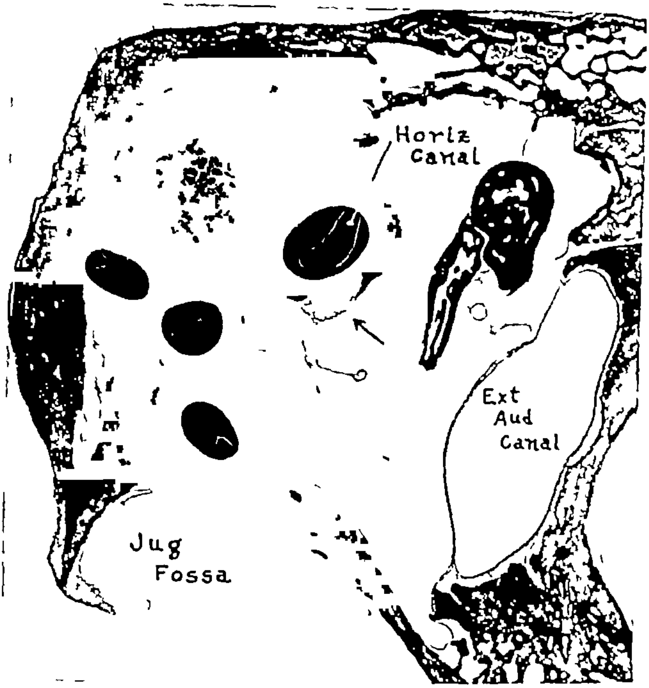


Fig 2 Photomicrograph at very low magnification of a section of the left temporal bone of a 63-year-old woman Her facial nerve (indicated by the arrow) in the region below the prominence of the horizontal semicircular canal is covered only by a thin layer of fibrous tissue and by normal middle-ear mucosa In operating on a patient with a similar gap in the continuity of the osseous wall of the facial canal especially in doing a fenestration operation via the endaural approach extreme care in the handling of instruments suction tips sponges and dressings would be necessary to avoid injury to the facial nerve

but do not portray well the histologic detail of the canal wall in the region of the defect All of the specimens are from adults, and in no instance does the histologic appearance, at

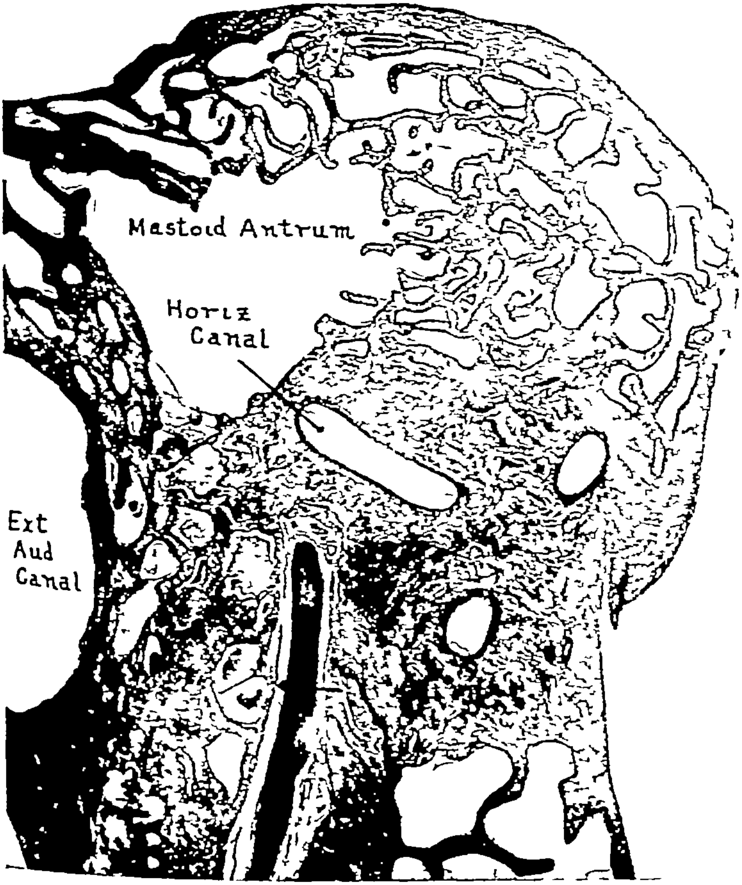


Fig 3 Photomicrograph at very low magnification of a temporal-bone section of a 27-year-old man showing almost the entire length of the descending or mastoid portion of the facial nerve The arrow drawn across the facial nerve indicates a region which has no bone between mastoid cells and the nerve

any magnification, give reason to suspect that a bony wall was previously present or that any bone of the region has been destroyed The gap in the bony wall of the canal is bridged simply by ordinary fibrous connective tissue, which is covered on the surface toward the middle-ear cavity, or toward the mastoid cells, by the epithelium normal for the region

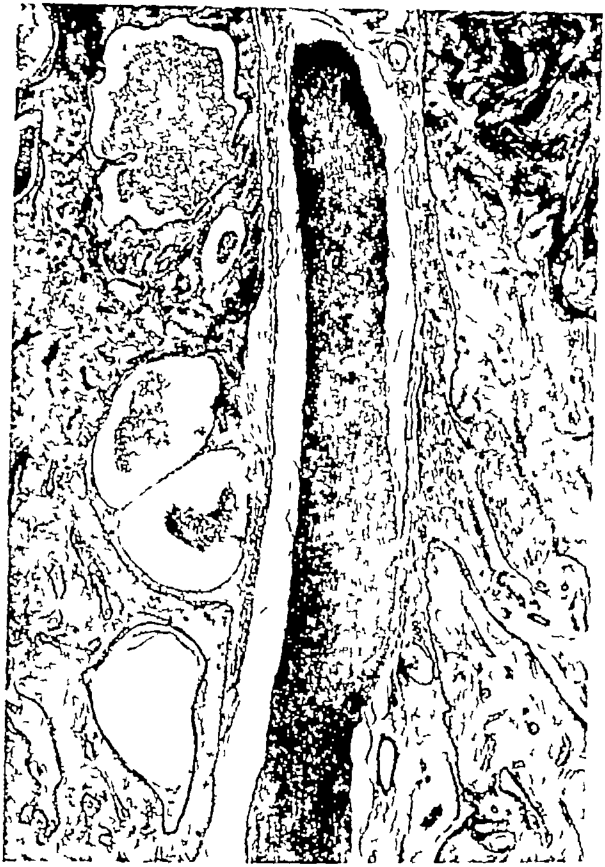


Fig 4 Photomicrograph of part of same section as is shown in Fig 3 at a magnification sufficient to show the structure of the wall between some of the mastoid cells of this ear and the facial nerve The mild infection present was a terminal event and was not the cause of the gap in the continuity of the bony wall of the facial canal

Large gaps of the bony wall of the canal, i e , large for the region, have been used for the illustrations, both in order to make the condition easily recognizable in low-magnification photomicrographs and to make obvious the potential dangers in case of an otologic operation on a patient with a similar anatomic condition Overgrowth of such a defect of the bony wall by granulation tissue would hide it from direct observation and thus further increase the risk of operative and of postoperative trauma to the facial nerve It is quite possible that many instances of facial paralysis have resulted from failure to recognize the presence of a gap in the continuity of the bony wall of the facial canal After a gap in the bony wall is recognized, proper precautions can, of course, be taken to avoid injury to the underlying nerve

The incidence of gaps in the continuity of the bony wall of the facial canal has not been determined, either for large defects such as are shown in the illustrations or for the more numerous smaller defects The impression gained by the writer, during the course of other studies of the laboratory's collection of temporal-bone sections, is that the frequency of occurrence is sufficient that the condition should be regarded as a variation rather than as an anomaly At least a dozen ears of the collection have large osseous gaps, of a size comparable to that shown in Fig 1, in the canal wall above the oval window, and for that region the writer believes the total incidence of gaps, of one size or another, is as high as 15 per cent The incidence is probably lowest in the descending, or mastoid, part of the canal

Bilateral symmetry of defects in the bony wall of the facial canal has been observed in numerous instances, including both the cases shown in Figs 1 and 2, but a systematic survey of the sectioned material of the laboratory has not been made from this standpoint If bilateral symmetry of the condition described is the rule, rather than the exception, heredity must be regarded as an important etiologic factor

In the individual case, it is quite impossible to know in advance of an operation whether or not part of the facial nerve lacks bony protection Every otologic operation should, therefore, be conducted in such manner as to avoid injury to the facial nerve if an unexpected gap in the continuity of the bony wall of the facial canal is actually present in the patient's ear

HEARING TESTS AND TESTING *†

STACY R GUILD, Ph D ,
Baltimore, Md

Hearing tests are numerous and varied Tests have been made by means of the spoken voice, by whispers, by tuning forks, by watch ticks, by acumeters, by clicking two coins together, by the Galton whistle, by Koenig bars, by monochords, by audiometers and by other means Tests of ability to hear also include pitch discrimination tests, fatigue tests, loudness-balance tests at a series of intensities, tests made with masking of the opposite ear, tests made with a masking sound introduced into the ear being examined, monaural and binaural tests, so-called open-field tests and tests with headphones, tests for malingering, tests for psychogenic deafness, etc , etc

In most instances, the brief phrases in the preceding paragraph represent not merely one hearing test but what may be called families of tests

Tests made with tuning forks, for instance, include the Weber test, the Schwabach test and its modifications, the Rinne test and its modifications, the Gelle test, the Bing test, the Fowler test, the Lewis test, the Frederici test, the Stenger test and others to which names are attached, besides the use of forks over a range of seven octaves or more to determine thresholds of hearing

---

*Presented by invitation at a Symposium on Problems of Deafness held under the joint auspices of the New York Academy of Medicine Section on Otolaryngology and the New York League for the Hard of Hearing on Feb 16 1949

†From the Otological Research Laboratory The Johns Hopkins University School of Medicine

Editor s Note This ms received in Laryngoscope Office and accepted for publication April 1 1949

Voice tests of hearing, likewise, are manifold They are made with the so-called live voice and with the recorded voice, and each of these is used for threshold tests and for tests of understanding at intensities above threshold The material used in voice tests of either type may be entire sentences or it may be numerals, or familiar words chosen for the pitch range of the essential sounds, or lists of nonsense syllables, or lists of phonetically balanced words, or lists of spondee bisyllabic words, etc All these voice tests may be administered monaurally or binaurally, by headphones or by open-field techniques, and with or without the use of masking

The phrase, *audiometer test* is another example of including many test procedures under one heading Not only does each audiometer test consist of a series of tests at different tonal frequencies but audiometers actually used in various parts of the world differ from one another in basic construction and in the calibration units used (decibels and Nepers and arbitrary values, such as in the Bunch-Dean instrument) The method of charting observations differs, for some audiometers normal hearing is recorded as a straight line, for others as a curved line Some audiometers generate discrete frequencies at fixed intervals, others generate a continuous range of frequencies With one of the latter type recently described, the patient makes his own audiogram by turning a control dial back and forth according to instructions given before the test is started Audiometers are used for both air-conduction and bone-conduction threshold tests, with and without masking, for loudness balance tests, for fatigue tests for tolerance tests, and for group testing as well as for individual tests

The above list of hearing tests, though incomplete, makes it obvious that an adequate presentation of the topic assigned to me in this symposium would require more time than is available In fact, hours of time would be needed to present comprehensively any one phase of the topic either to describe each hearing test, or to discuss the merits of each test or the way each test should be performed, or the possible sources of errors in each technique, or the possible interpretations of the results of each test, or the evidence that the interpretations customarily made of each test are actually warranted by the facts It is, therefore, necessary that the presentation of the topic this evening be limited mostly to statements of general principles and conclusions

The reasons for making hearing tests are many They range from a desire to determine fitness for a given occupation, such as a school child or a soldier or a telephone operator, to attempts to gather data on which to base, or to modify, the design of complicated electrical apparatus, such as a telephone circuit or a recording instrument Hearing tests are sometimes made merely to impress or to satisfy patients who have read popular articles about the scientific wonders of the age and who accordingly feel they have not had a good examination unless a lot of gadgets are used The usual reason an otologist makes hearing tests is to get information that may help determine why the patient has impaired hearing and whether any treatment is indicated, occasionally he wishes also to learn approximately how much impairment of hearing the patient has, for comparison with later tests

Whatever the reason may be for making hearing tests, the tests to be used should be chosen to yield the desired information For instance, if one wishes to know how well a patient understands speech, voice tests should be used, not a series of pure tones The otologist, confronted by the multiplicity of hearing tests, often has difficulty choosing the best ones to use This difficulty is not new, though we of the present day may sometimes think it is Over a half-century ago, Bezold, who himself originated a series of test procedures, wrote about the need to limit hearing tests to the purposeful ones and complained about time-consuming unnecessary tests The advent of oscillating electrical circuits and electronic amplifiers has merely accentuated the dilemma faced by practicing otologists

Whatever the reason may be for testing the hearing, and whether or not the tests chosen be simple ones or ones that require the use of complicated apparatus, the tests made, if they are to have any value, must be made carefully and must be made under proper conditions In spite of all that has been published and spoken about the need for quiet surroundings in which to make hearing tests, and about the importance of masking the better ear when the poorer one is being examined, both of these factors essential to obtaining reliable results are even this year more honored in the breach than in the observance, furthermore, in spite of all warnings, every day of the year defective tuning forks are used, watches of unknown acoustic characteristics are used, audiometers badly out of correct calibration are used, audiograms are made by unskilled personnel, etc The results of such tests are, at best, misleading If acoustical physicists and electronics engineers were habitually as careless in making their hearing tests as are many persons who do clinical testing, both in medical circles and in other fields, we would not yet have good telephone circuits, good radios, good phonographs or good "talking movies," except it be by accident

Mistakes are more apt to be made in using electrical apparatus or complicated techniques than in making simple tests When the data from the various tests made of a patient's hearing are not consistent with each other, the inclination should, therefore, be to trust the impressions gained from the simpler tests, provided there is no reason to suspect malingering and no opportunity to repeat the tests The best procedure, of course, is to repeat the tests after ascertaining that the apparatus actually is in proper operating condition in all respects and is being properly used With cooperative patients such a repetition of the tests usually eliminates the supposed discrepancies and results in confirming the impressions given by the simpler tests of the first examination

Inconsistencies between parts of a group of tests, or between successive tests on different occasions, are often regarded as indicating either malingering or the presence of a psychogenic factor in the impairment The inconsistencies may, however, be due to nothing more serious than the fact that the patient has "auditory after-images" Experienced otologists are familiar with this phenomenon, but oftentimes their assistants, who actually make the hearing tests, are not aware of the possible complicating factor Accordingly, the test is made at a speed that is all right for patients who do not have "auditory after-images" of faint sounds but that is too fast for patients who do have this annoying condition When the examiner of such a patient forgets to vary the intervals between interruptions of the test tones, he may be misled into thinking the patient's threshold is normal when it actually is impaired as much as 55 or 60 db The potential harm to the patient of such an error is considerable, especially if the inconsistencies between tests are interpreted as indicating malingering or psychogenic deafness

The data obtained by the making of hearing tests, whether they be simple or complex tests, are merely marks on paper until interpreted The interpretations desired may be in terms of placement in school, of assignment to a job, of design of a hearing aid, or in terms of the cause of an impairment of hearing For clinical purposes, the results of hearing tests, no matter how detailed and reliable the tests be, have value only when the data are interpreted in the light of the information furnished by a thoughtfully taken history and a good physical examination For instance, by no battery of hearing tests can a diagnosis be made of the cause of a conductive deafness, which may be due to impacted cerumen, to otosclerosis, or to some other cause, nor can the hearing tests alone distinguish between the impaired hearing normal for an elderly person but abnormal when found in a child nor between the possible causes of total deafness For most patients, a few simple tests suffice to provide all the information needed to supplement the history and the physical examination, more tests do not change either the diagnosis or the decision as to what treatment, if any, is indicated

If enough were known about the subject of the relation of lesions to impaired hearing, it might well be worthwhile in clinical work to make elaborate hearing tests routinely Most of the lesions, however, that cause impaired hearing can be studied only by histologic examination after death By this method important correlations have been made with hearing losses known to have been present during life, but the number of cases that have been thus studied is too small to warrant conclusions as to the effect on hearing of small differences in lesions of the same general type In other words, as yet only large differences in hearing can be correlated with differences in the lesions responsibile for the impaired function

The conclusion is inescapable that the knowledge needed to interpret hearing tests intelligently has not increased as rapidly as have testing techniques Factual information about the physiology of the organ of hearing, which includes parts of the brain, is as yet so incomplete that for many hearing tests hypothetical interpretations only can be made with respects to lesions possibly responsible for an impaired function revealed and measured by the tests

The gaps in our knowledge are at present so great that a clinician might well apply the following basic questions to each proposed hearing test *1* What may I learn, that I do not already know, by making this test? *2* How good is the evidence that the interpretations made of data obtained by this tests are correct? *3* If correct, what value do the interpretations made of the data from this test have in the care of patients? In other words, the clinician should make a clear distinction between tests for research purposes and tests for clinical purposes, and he should recognize clearly that nothing is gained clinically by the making of hearing tests that cannot be interpreted with reasonable certainty into terms of causative lesions All too often a diagnosis, so-called, amounts to nothing but a statement of the kinds of hearing defects found by the tests made Such a statement, no matter how elaborate the battery of tests used or how detailed the report of the data obtained, is merely a description, and not an interpretation, of hearing tests, and has no medical usefulness whatsoever The situation constitutes a challenge to investigators, both laboratory and clinical

A METHOD FOR IMPROVEMENT OF THE CURVED NASAL TIP

J EASTMAN SHEEHAN, M D , and WILSON A SWANKER, M D ,
New York, N Y

The reconstruction of the tip of the nose, particularly of the soft parts, is infinitely more complex than those of the hard parts The difficulties encountered in obtaining a satisfactory end-result in the correction of the nasal tip are the tip, the columella and the nostrils

At the conclusion of the usual rhinoplastic operation, especially when a parrot-shaped tip is present, the extreme point of the nose may remain too rounded and flat Although the technical steps of the operation may have been properly executed, as far as the frame work is concerned, there still remains a somewhat curved contour

To correct this tendency, a small piece of cartilage, more or less rhomboid in shape, 12 mm in each dimension, is inserted into the subcutaneous tissue of the nasal tip This cartilage can readily be obtained from the resected alar cartilages or cadavoric cartilage (it is equally as good) If the pieces are not sufficiently thick, the thin material may be laminated and held together with one plain catgut suture

Before the columella is sutured, the skin at the nasal tip is freed from its underlying structures along the inner and outer horns of the lower alar cartilages The columella is then sutured to the septum, employing the so-called orthopedic stitch The small rhomboid of cartilage that has been previously prepared is introduced beneath the skin at the extreme

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication Feb 28 1949

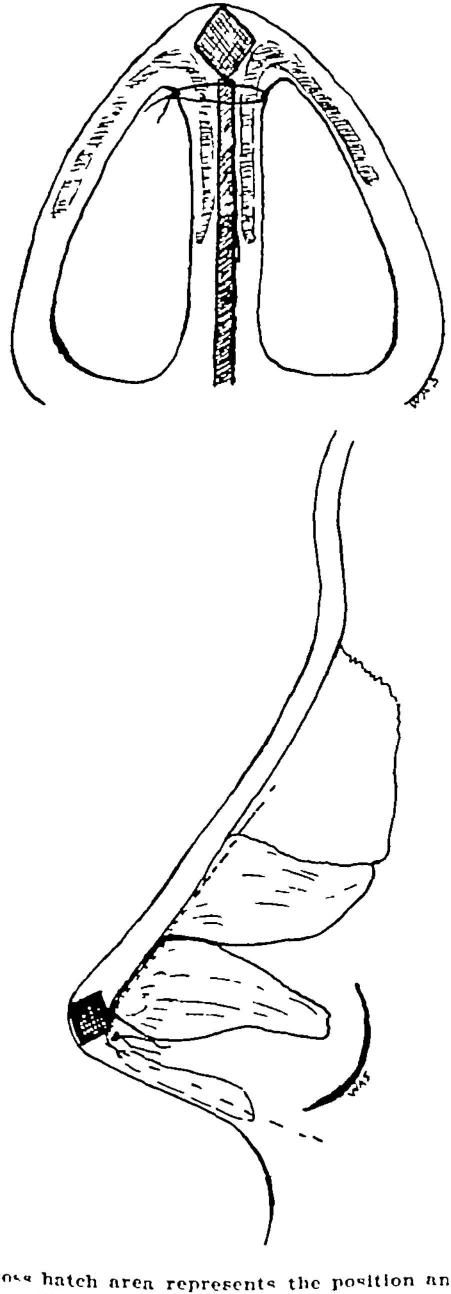
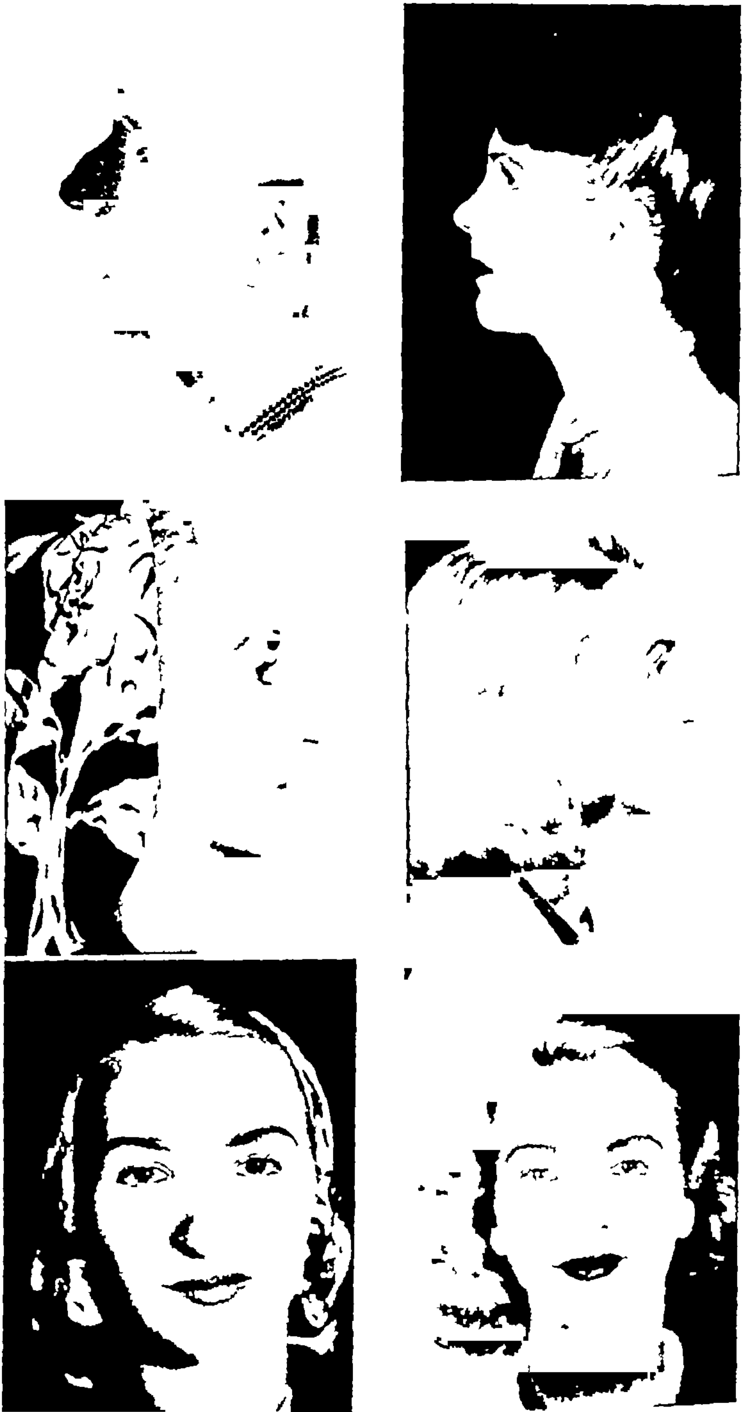


Fig. 1 The cross hatch area represents the position and relationship of the rhomboid of cartilage



tip of the nose, with its longitudinal axis corresponding to that of the nose It comes to rest at the uppermost part of the columella When the rhomboid of cartilage is in place, a mattress suture is passed through the columella at its uppermost part This suture secures the rhomboid in its new position If there is any doubt that the morsel of cartilage is not secure, an alternative method of fixation may be employed A fine nonabsorbable suture may be passed through the rhomboid With a needle affixed to each end, the suture ends are passed through the skin of the nasal tip in such a way as to secure the rhomboid in the desired position

The tip assumes a pleasing retrousse effect instead of the ordinary flat tip This effect obtained is assured by immobilization of the rhomboid by a narrow strip of adhesive tape placed below the extreme point of the cartilage and another piece above the rhomboid

As a result of employing the morsel of cartilage (rhomboid in shape), three things are accomplished

1 The tip of the nose is more definitely defined

2 The columella is lengthened

3 The borders of the nares assume a more graceful curve

JOINT MEETING SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY AND NORTH CAROLINA EYE, EAR, NOSE AND THROAT SOCIETY

The joint meeting of the South Carolina Society of Ophthalmology and Otolaryngology and the North Carolina Eye, Ear, Nose and Throat Society will be held at Hotel Poinsett, Greenville, S C, Sept 12 through Sept 15 The following program will be presented

Dr A. D Ruedemann, professor of ophthalmology, Wayne University, Detroit, Mich

1 The Differential Diagnosis Between Unilateral and Bilateral Ocular Protrusion
2 The End-Results with New Radium-D Applicator in Comparison to Radon
3 Ocular Manifestations of Allergy

Dr Peter C Kronfeld, department of ophthalmology, Illinois Eye and Ear Infirmary, University of Illinois, Chicago, Ill

1 Differential Diagnosis of Acute Glaucoma
2 Prognosis of Retinal Detachment
3 Newer Drugs in Ophthalmology

Dr Rudolph Aebli, professor of ophthalmology, New York University, Bellevue Medical Center, Post-Graduate Medical School, New York, N Y

1 The Relationship of Muscle Imbalances to the Palpebral Aperture and Pseudo-Ptosis
2 Principles of Ocular Muscle Surgery
3 Congenital Muscle Anomalies

Dr Carl C Johnson, associate department of ophthalmology Harvard University, Boston Mass

1 Surgical Treatment of Ptosis

2-3 The Diagnosis and Surgical Treatment of Glaucoma

Dr Preston C Iverson New York N Y

1 Neoplasms of the Lip, Nose and Eyelid and Plastic Repair of the Lesions

2 Congenital Deformities of the Face

Dr Louis H Clerf Philadelphia Pa

1 Cough Viewed from Otolaryngologic Standpoint

2 Paralysis of Larynx Surgical Treatment

3 Malignant Neoplasms of Larynx

Dr Kenneth M Day, Pittsburgh Pa

1 Clinical Management of Deafness

2 Meniere s Disease

Dr Russell A Sage Indianapolis Ind

1 Diseases of the Mouth and Tongue

South Carolina Society of Ophthalmology and Otolaryngology President Dr Pierre G Jenkins Vice-President Dr Murdock Walker Secretary-Treasurer Dr Roderick Macdonald

North Carolina Eye Ear Nose and Throat Society President Dr James Harrill Vice-President Dr G M Billings Secretary-Treasurer Dr MacLean B Leath

For further information address Dr Roderick Macdonald Secretary South Carolina Society of Ophthalmology and Otolaryngology Rock Hill S C or Dr MacLean B Leath Secretary North Carolina Eye Ear Nose and Throat Society

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp, 580 Fifth Ave, New York 19, N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St., Chicago, Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac, Beltone Symphonette

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St, Chicago, Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co, Inc, 10 East 43rd St., New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc, 50 W 29th St., New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co, Inc, North Third St., Minneapolis, Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp, 1 W 34th St New York, N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co, 727 Atlantic Ave, Boston 11, Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic.

Manufacturer Microtone Co, 4602 Nicollet Ave, Minneapolis 9, Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories 815 S Hill St. Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4

Manufacturer Otarion Hearing Aids 159 N Dearborn St., Chicago Ill.

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)

Manufacturer Paraphone Hearing Aid Inc. 2056 E 4th St. Cleveland Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale Chicago 14 Ill

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone, Radioear Permo-Magnetic Multipower—report not yet published

Manufacturer E A. Myers & Sons 306 Beverly Rd Mt. Lebanon Pittsburgh Pa.

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp 6001 W Dickens Ave., Chicago Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp 101 Tremont St. Boston 8 Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford N Y

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp, 580 Fifth Ave, New York 19, N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St, Chicago, Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac, Beltone Symphonette

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St, Chicago, Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co, Inc, 10 East 43rd St, New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc, 50 W 29th St, New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co, Inc, North Third St., Minneapolis, Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp, 1 W 34th St New York, N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co, 727 Atlantic Ave, Boston 11, Mass

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer 20 Charlesgate, West Boston 15, Mass
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3, N Y
Meeting Mark Hopkins Hotel San Francisco Calif, May 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A Fenton 906 Medical Arts Bldg Portland Ore
Secretary Louis H. Clerf, 1530 Locust St, Philadelphia 2, Pa
Meeting Mark Hopkins Hotel San Francisco, Calif May 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin 384 Post St., San Francisco 8 Calif
Secretary Dr C Stewart Nash, 708 Medical Arts Building Rochester N Y
Meeting Mark Hopkins Hotel San Francisco Calif May 1950

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St. Charlottesville Va
Secretary Dr James M Robb 641 David Whitney Bldg Detroit Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens 35 E 70th St New York N Y
President Elect Dr J Mackenzie Brown 1136 W 6th St. Los Angeles Calif
Executive Secretary Dr William L Benedict Mayo Clinic Rochester Minn
Meeting Palmer House Chicago Ill Oct 9 14 1949

Superfonic Hearing Aid

Manufacturer American Sound Products, Inc 2454 S Michigan Ave, Chicago, Ill

Televox Model E

Manufacturer Televox Mfg Co, 117 S Broad St Philadelphia 7 Pa

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex, Inc, Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc, 1627 Pacific Ave, Dallas 1, Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm, Inc, 400 W Lake St, Libertyville, Ill

Unex Model "A", Unex Midget Model 95, Unex Midget Model 110

Manufacturer Nichols & Clark Hathorne, Mass

Vacolite Model J

Manufacturer Vacolite Co 3003 N Henderson St Dallas 6 Tex

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc 120 Broadway, New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave, Chicago, Ill

All of the accepted hearing devices employ vacuum tubes

THE
LARYNGOSCOPE.

VOL LIX JULY, 1949 NO 7

HEMATOLOGY

JOHN JOSEPH SHEA, M D , and JOHN JOSEPH SHEA, JR , M D ,
Memphis, Tenn

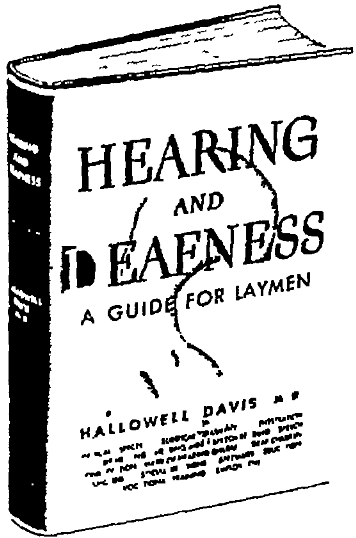
INFECTIOUS MONONUCLEOSIS

This condition was first described by Pfeiffer, of Vienna, in 1889 under the name of glandular fever The disease received little publicity for many years, even during World War I, when many cases doubtless occurred but were not reported Since the publication by Sprunt and Evans of another account of the disease in 1920, under the name Infectious Mononucleosis, numerous reports of isolated and epidemic cases, including some with bizarre complications, have appeared in the literature

The disease is clearly infectious, but the epidemiology is obscure The infecting agent is a virus, and the disease has been transmitted in monkeys by an agent obtained from bacteria-free nasal washings[1] The exact mode of transmission is not known, but it seems to be by droplet infection similar to the common cold Cases may occur sporadically or in epidemic form The virus is highly infectious, though it resembles other viruses in that inapparent infection is common This may explain why some persons, exposed to the

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 27 1949



The answers to problems of DEAFNESS

for the hard of hearing
and those who
work with them

JUST PUBLISHED

HEARING AND DEAFNESS

Edited by HALLOWELL DAVIS, M D
Director of Research Central Institute for the Deaf Research Professor of Otolaryngology
Washington University School of Medicine

A MURRAY HILL BOOK
496 pages, 6 x 8½, 142 helpful illustrations, $5 00

Expert guidance from
14 specialists

1 AUDIOLOGY A MEETING OF VARIED SPECIALISTS
2 PHYSICS AND PSYCHOLOGY OF HEARING
3 ANATOMY AND PHYSIOLOGY OF THE EAR
4 MEDICAL ASPECTS OF HEARING LOSS
5 SURGICAL TREATMENT OF HEARING LOSS
6 TESTS OF HEARING
7 HEARING AIDS
8 THE CHOICE AND USE OF HEARING AIDS
9 SPEECH READING
10 AUDITORY TRAINING
11 CONSERVATION OF SPEECH
12 MILITARY AURAL REHABILITATION
13 FROM ARISTOTLE TO BELL
14 HARD-OF HEARING CHILDREN
15 DEAF CHILDREN
16 THE PSYCHOLOGY OF THE HARD OF HEARING AND THE DEAFENED ADULT
17 ORGANIZATIONS FOR THE AURALLY HANDICAPPED
18 EMPLOYMENT FOR THE HARD OF HEARING
19 VOCATIONAL GUIDANCE FOR THE DEAF

HERE, in a single, easily-understood volume, is in tensely practical guidance in dealing with the many physical, social and economic handicaps of deafness Edited by Dr Hallowell Davis, HEARING AND DEAF NESS was written in collaboration by 14 experts Each brings the latest advice and information on that par ticular phase of the subject with which years of speciali zation have best equipped him or her to deal Their aim is to help hard-of-hearing people in the most practical way possible by making them fully informed by guiding them in seeking relief through modern scientific developments, by helping them avoid useless expendi tures and disappointments and finally, if relief is not forthcoming, to retain speech powers, to hold jobs and otherwise live as normally as possible

Primarily written for the sufferers themselves the book is of equal value to physicians educators sociologists and families of hard-of-hearing victims—to all who must in one way or another, play a part in alleviating this dis tressing condition

" *should be in the hands of all the thousands of those who ask the questions and want to get the cor rect answers* "

—*C STEWART NASH President American Hearing Society*

" *Here, at last, is information, correct easy to read, covering nearly every phase of the problem in a manner suited to laymen HEARING AND DEAFNESS should be the means of greatly lessening the handicap of deafness* '

—*LOUISE TRACY The John Tracy Clinic*

Order from

The Laryngoscope
640 So Kingshighway St Louis 10, Mo.

THE
LARYNGOSCOPE.

VOL. LIX JULY, 1949 NO. 7

HEMATOLOGY

JOHN JOSEPH SHEA, M.D., and JOHN JOSEPH SHEA, JR., M.D.
Memphis, Tenn.

INFECTIOUS MONONUCLEOSIS

This condition was first described by Pfeiffer, of Vienna, in 1889 under the name of glandular fever. The disease received little publicity for many years, even during World War I when many cases doubtless occurred but were not reported. Since the publication by Sprunt and Evans of another account of the disease in 1920, under the name Infectious Mononucleosis, numerous reports of isolated and epidemic cases, including some with bizarre complications, have appeared in the literature.

The disease is clearly infectious, but the epidemiology is obscure. The infecting agent is a virus, and the disease has been transmitted in monkeys by an agent obtained from bacteria-free nasal washings.[1] The exact mode of transmission is not known, but it seems to be by droplet infection similar to the common cold. Cases may occur sporadically or in epidemic form. The virus is highly infectious, though it resembles other viruses in that inapparent infection is common. This may explain why some persons exposed to the

---

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication April 2, 1949.

infection, do not contract the disease[2] The infective period is unknown One attack probably confers a lasting immunity, and reported recurrences are probably due to a similar condition of infectious lymphocytosis, or other infections, or to relapses of the original infection It occurs in all ages, but is most common in children

The incubation period is approximately five to 15 days The milder cases can be divided into three groups according to the classification of Tidy[3] The glandular fever type occurs in children and is characterized by enlargement of the cervical glands and little inflammation of the throat The angiose type occurs in young adults and is characterized by the development of a true membrane on the throat, with enlargement and tenderness of the cervical glands There is fever out of proportion to the patient's appearance The membrane separates within a week, and the patient rapidly improves The adult type is more insidious, often preceded by a longer incubation period and accompanied by less glandular enlargement and inflammation of the throat The prolonged fever is most characteristic, but it is difficult to distinguish from other causes of prolonged fever There is lymph node enlargement, most frequently in the postcervical chain, and this may be tender The spleen is palpable in about half the cases

Severe cases have been reported complicated by splenic rupture,[4] encephalitis and other neurological disorders,[5] hepatitis, with and without jaundice,[6] and thrombocytopenic purpura[7] The disease may resemble the acute surgical emergencies of the abdomen, poliomyelitis, Guillian-Barré syndrome, or other neurological infections, hepatitis, or the many syndromes associated with thrombocytopenic purpura, according to the complication present These widespread manifestations have been explained by the generalized involvement of the cases which have come to autopsy Focal infiltrations of mononuclear cells in a number of organs, including the liver, heart, kidneys, lungs, spleen, testicles and brain, have been observed[8]

Diagnosis is made from the clinical course when it is typical, and from the blood when it is not In the milder forms, there may be an initial leucocytosis, from 15,000 to 20,000 cells, with 75 per cent polys This finding may be entirely misleading if another count is not done Usually there is a leucopenia of the polymorphonuclear cells from the onset The abnormal lymphocytes characteristic of the disease then appear, with round or bean-shaped nuclei, usually without nucleoli, and with abundant "foamy" cytoplasm which may be folded on itself These cells are not confined to infectious mononucleosis alone, but are found in a number of other infectious diseases There is then a lymphocytosis for a variable length of time Difficulties arise in the differentiation from acute leucemia, which usually shows more young forms in the blood and more toxicity, and chronic lymphatic leucemia, the early stages of which closely mimic infectious mononucleosis The heterophile agglutination test of Paul and Bunnel is helpful in making the diagnosis in all but the most obvious cases A significant titer varies with the method employed, so will vary from place to place A positive reaction may occur very early, as in the milder cases, or it may not appear later with subsidence of the constitutional symptoms, so it is best in suspected cases to repeat the test where it is negative when first done A positive test is considered diagnostic, but a negative test does not preclude the diagnosis since about 10 per cent of these cases fail to demonstrate antibodies

The course of the disease is usually benign Treatment is directed at the complications, since there is no effective treatment of the primary disease Perhaps gamma globulin, especially that from a convalescent patient (vide infra) may be of benefit in attenuating or preventing the disease

Our experience with aureomycin has been too limited to warrant a definite statement, but in the few cases so treated the angina and the cervical adenitis receded rapidly

THROMBOCYTOPENIA

The conditions likely to be associated with a reduction in the platelets are the exanthemata and drug sensitivity Scarlet fever,[9] German measles[10] and chicken pox[11] have recently been reported in association with thrombocytopenia, prompt recovery usually taking place coincident with recovery from the exanthemata It has also been reported following the administration of potassium iodide,[12] quinidine[13] and associated with pancytopenia following the administration of tridione, a new anticonvulsive [14] The presence of idiopathic thrombycytopenia must always be suspected in such cases, even when a potentially dangerous drug has been administered The idiopathic cases have the characteristic immature, nonproductive megakaryocytes in the marrow in abundance, as compared to those produced by drugs which have none Treatment consists in removal of the causative agent, if one is known, and administration of methionine, or foods rich in this amino acid, B complex vitamins, including folic acid, and fresh transfusions

GRANULOCYTOPENIA

The occurrence of bone marrow hypoplasia associated with the drugs commonly used is being reported with alarming frequency and should be kept in mind Following its widespread use in the war,[15] atabrine has been implicated, causing aplastic anemia Tridione, a benzene derivative, has proven to be a bone marrow depressant in some patients, causing thrombocytopenia, as noted above, and granulocytopenia This effect comes on insidiously without relation to size or duration of dosage and is corrected when the dose is discontinued The white count of such patients should be followed at regular intervals It is a well known fact that thiouracil and the sulfonamides can cause depression of the white count, especially the granulocytes The same treatment as for thrombocytopenia should be given, pentanucleotides have also been used with equivocal results

BLOOD DERIVATIVES

The vast program of red cell preservation and plasma fractionation carried on by Cohn, *et al*, since 1941 for the National Research Council and other agencies has resulted in a much better understanding of the contents and functions of the blood In addition, many useful products have been made available An acid dextrose citrate solution has been found which will preserve 70 to 80 per cent of the red cells for 21 days, if stored at a temperature between 4 to 10°[16] Plasma and albumen have been used to increase the circulating protein in conditions where it is decreased, such as in shock and in the preparation of debilitated patients for surgery

For the otolaryngologists, the most important derivatives are those which assist coagulation Fibrin foam is a light, absorbable material which when used with thrombin has proven effective in a variety of surgical conditions It deserves a try in cases of epistaxis resistant to routine cautery and packing[17] Fibrin film, containing thrombin, was first used as a dural substitute but has recently been employed to repair perforations of the drum and nasal septum[18] It is pliable and can easily be molded into a suitable shape In suspected or frankly infected areas, these agents are equally effective with the sulfonamides and penicillin Recently, "gelfoam," absorbable gelatin sponge,[19] and "oxycel," oxidized cellulose,[20] have received clinical trial, especially in nasal packing for epistaxis They seem to be as effective as the blood derivatives, and together with them have the advantage over routine packing, in that they are absorbable and do not have to be removed Thrombin has been used in nasal surgery to facilitate the attachment of skin flaps[21] and together with fibrinogen has been used in plastic surgery[22] Fraction I of Cohn contains the specific antihemophilia globulin "thromboplastinogen," and 200 to 600 mg of this given intravenously will temporarily restore the clotting mechanism of a hemophiliac to normal This will allow him to undergo minor surgery without complication from hemorrhage and stops bleeding when it occurs following an accident[23]

The gamma globulins present in Fraction II contain the antibodies circulating in the plasma These can attenuate or prevent epidemic hepatitis[25] or measles, depending on how early they are given[24] The antibodies for mumps are present in very low titer in normal plasma but are present in much greater quantity in the plasma of convalescent patients Such convalescent globulin will markedly reduce the occurrence of orchitis in adolescent and adult males with mumps, and if given early enough may have a beneficial effect on the encephalitis that occasionally complicates mumps, with its resultant deafness[26] Similar convalescent gamma globulin is available for the prevention and treatment of pertussis

A serious disadvantage to the use of plasma fractions is the frequency of homologous serum jaundice following their use The pooling of plasma prior to fractionation permits a thorough mixing of the infected plasma with the rest The great resistance of the causative virus permits it to remain viable during the process of fractionation Measures have been developed for the inactivation of the virus during fractionation, the most prominent being ultraviolet light[27]

THE CHEMOTHERAPY OF LEUCEMIA AND LYMPHOMA

NITROGEN MUSTARD

The poisonous mustard gas used in World War I exerted its harmful effect by its surface vesicant action, although at that time it was known to cause leucopena[28] The renewed interest in poison gas in this war was centered around mustard gas and several of its nitrogenous analogues They were found to have cytotoxic action on many issues when given internally This action was unique for a chemical agent and resembled X-ray more closely than anything else

The mode of action of these drugs is probably the inactivation of intracellular enzyme systems by the alkalinization of their essential carboxyl, sulfahydroxyl and amino groups There is no indication that these compounds are specific for malignant tissue, however, since in smaller doses they prevent mitoses all over the body, their action is most marked in the rapidly dividing malignant tissues Given in larger doses, they cause nuclear fragmentation and changes in the cytoplasm, and perhaps this mechanism is responsible for their clinical usefulness

These drugs have been given a thorough clinical trial on patients with malignant disease. Encouraging results have been obtained in Hodgkin's disease, lymphosarcoma, chronic myelocytic and chronic lymphatic leucemia and polycythemia vera.[3, 4] The reduction in pain and fever following treatment has been especially promising, in some cases, almost immediate. Often there is reduction in the size of the spleen and lymph nodes and a return of the feeling of well-being. Solitary lesions are probably best treated by X-ray, mustard being reserved for the more generalized variety and for those resistant to X-ray, since they will occasionally undergo a satisfactory response to mustard when they will no longer respond to radiation. There is no evidence to indicate that mustard is superior to well administered X-ray, and it is probably a matter of convenience which form of treatment is used. As with X-ray, the remissions induced depend on the disease being treated. Nitrogen mustard has little beneficial effect in the acute leucemias, and since it may depress hemoglobin formation, it is not recommended.

The most effective compound tested to date has been methyl bis (B chlor ethyl) amine hydrochloride. The dose is 0.1 mg/kg of body weight intravenously in saline for three to six consecutive days, depending on the white count. Care must be taken to see that none of the solution enters the tissues around the vein because of its irritating effect. Nausea and vomiting usually follow the first few treatments. The amount of drug given is usually limited by the white count since it tends to fall, especially in polys; there may also be a depression in the platelets. In those patients who respond, there is usually a rise in the red count if it was low before treatment. Recovery from the depressant effect on the blood is usually complete in four to six weeks, at which time a second series of treatment may be given if necessary. Just as with X-ray, a lesion which has responded well the first time may fail to do so, or may respond only slightly the next time.

URETHANE

In 1946, Haddon and Sexton reported the inhibitory effect of the common laboratory anesthetic, urethane (ethyl car-greater quantity in the plasma of convalescent patients Such convalescent globulin will markedly reduce the occurrence of orchitis in adolescent and adult males with mumps, and if given early enough may have a beneficial effect on the encephalitis that occasionally complicates mumps, with its resultant deafness [26] Similar convalescent gamma globulin is available for the prevention and treatment of pertussis

A serious disadvantage to the use of plasma fractions is the frequency of homologous serum jaundice following their use The pooling of plasma prior to fractionation permits a thorough mixing of the infected plasma with the rest The great resistance of the causative virus permits it to remain viable during the process of fractionation Measures have been developed for the inactivation of the virus during fractionation, the most prominent being ultraviolet light [27]

THE CHEMOTHERAPY OF LEUCEMIA AND LYMPHOMA

NITROGEN MUSTARD

The poisonous mustard gas used in World War I exerted its harmful effect by its surface vesicant action, although at that time it was known to cause leucopena [28] The renewed interest in poison gas in this war was centered around mustard gas and several of its nitrogenous analogues They were found to have cytotoxic action on many issues when given internally This action was unique for a chemical agent and resembled X-ray more closely than anything else

The mode of action of these drugs is probably the inactivation of intracellular enzyme systems by the alkalinization of their essential carobxyl, sulfahydroxyl and amino groups [29] There is no indication that these compounds are specific for malignant tissue, however, since in smaller doses they prevent mitoses all over the body, their action is most marked in the rapidly dividing malignant tissues Given in larger doses, they cause nuclear fragmentation and changes in the cytoplasm, and perhaps this mechanism is responsible for their clinical usefulness

These drugs have been given a thorough clinical trial on patients with malignant disease. Encouraging results have been obtained in Hodgkin's disease, lymphosarcoma, chronic myelocytic and chronic lymphatic leucemia and polycythemia vera.[30-34] The reduction in pain and fever following treatment has been especially promising, in some cases, almost immediate. Often there is reduction in the size of the spleen and lymph nodes and a return of the feeling of well-being. Solitary lesions are probably best treated by X-ray, mustard being reserved for the more generalized variety and for those resistant to X-ray, since they will occasionally undergo a satisfactory response to mustard when they will no longer respond to radiation. There is no evidence to indicate that mustard is superior to well administered X-ray, and it is probably a matter of convenience which form of treatment is used. As with X-ray, the remissions induced depend on the disease being treated. Nitrogen mustard has little beneficial effect in the acute leucemias, and since it may depress hemoglobin formation, it is not recommended.

The most effective compound tested to date has been methyl bis (B chlor ethyl) amine hydrochloride. The dose is 0.1 mg./kg. of body weight intravenously in saline for three to six consecutive days, depending on the white count. Care must be taken to see that none of the solution enters the tissues around the vein because of its irritating effect. Nausea and vomiting usually follow the first few treatments. The amount of drug given is usually limited by the white count since it tends to fall, especially in polys, there may also be a depression in the platelets. In those patients who respond, there is usually a rise in the red count if it was low before treatment. Recovery from the depressant effect on the blood is usually complete in four to six weeks, at which time a second series of treatment may be given if necessary. Just as with X-ray, a lesion which has responded well the first time may fail to do so, or may respond only slightly the next time.

URETHANE

In 1946, Haddon and Sexton reported the inhibitory effect of the common laboratory anesthetic, urethane (ethyl carbamate), on rat cancer[35] For this reason it was tried on human cancer with little success A leucopenia was observed in these patients during treatment It was, therefore, given to patients with leucemia and found to have a favorable effect on one-third, causing a reduction in the size of the lymph nodes and spleen, and reversal of the blood picture toward more normal values[36] It has the advantage of being almost nontoxic, and can be given by mouth The dose is 3 to 4 gms per day for 42 days, and a maintenance dose of 0 5 to 1 Gm usually sustains this effect

FOLIC ACID ANTAGONISTS

The widespread and fundamental importance of folic acid in hematopoiesis is apparent from its action upon all the elements of the marrow[37] Farber, *et al*, noticed an "acceleration phenomenon" in the leucemic process in children with acute leucemia following the injection of folic acid conjugates[38] It was, therefore, supposed that some antagonists of folic acid could be synthesized, which would block this action of folic acid in leucemic patients and restore the blood toward normal Such compounds have been developed and are now being tested, the most promising being aminopterin[39]

RADIOACTIVE ISOTOPES

Many of the elements have been prepared in isotopic form for the treatment of neoplastic disease The purpose in doing this is to selectively deposit radioactive material in the disease area to exert its destructive effect locally The difficulty is finding a material which can be concentrated sufficiently in the tissue to be treated The most promising is radioactive phosphorus in the treatment of polycythemia vera, but this does not seem to be superior to nitrogen mustard[40] There is promise in the use of these radioactive elements, but much better ones need to be developed

HEMORRHAGIC DISORDERS

The great amount of investigative work done on the clotting mechanism has added to the understanding of this process, but has not changed any of the basic elements as outlined by Howell in 1935[41] The recent excellent paper by Quick, Honarato and Stefanini outlines the coagulative process as follows [42]

1 Thromboplastinogen platelet enzyme thromboplastin
  The activated thromboplastin reacts immediately
2 Thromboplastin + prothrombin + calcium = thrombin
3 Fibrinogen thrombin fibrin

The main difference with the older theory is concerned with thromboplastin It is now thought to come from the plasma, not the platelets, but requires an enzyme from the platelets to convert it to an active form

In hemophilia, the thromboplastin precursor in the plasma is almost absent, but when this is supplied, as by fresh plasma or the Fraction I of Cohn, the blood of hemophiliacs clots readily and well To understand hemophilia, it must be understood that a small amount of thrombin, formed from only a very small amount of thromboplastin precursor and prothrombin, is enough to initiate coagulation This explains why hemophiliacs can have a normal or nearly normal clotting time as done by the most accurate methods[43] and yet suffer from repeated hemorrhages Since they have only a small amount of thromboplastin precursor, they form only a small amount of thrombin, which can convert only a small amount of fibrinogen to fibrin This small amount of fibrin may be enough to clot blood in a test tube, but not enough to occlude a severed blood vessel, hence, the patient may have a normal clotting time and yet not be able to clot blood in a severed vessel, especially if it is a larger one This demonstrates the unreliability of the clotting time in hemophilia It is of value only when it is normal, or only slightly elevated, since such patients can be predicted to have only slight bleeding The amount of prothrombin remaining in the plasma after clotting time is a more reliable test of the coagulative defect in hemophilia since very little is removed Normally most is removed during coagulation

The prothrombin time as measured by the method of Quick is a chemical determination of the prothrombin activity. It is important to remember that prothrombin combines with thromboplastin and that if prothrombin is deficient, clotting will not occur or will be defective. The *hemorrhagic danger* level is indicated by a prothrombin time of 25 seconds, which corresponds to a prothrombin activity of 20 per cent. Dicoumarol, the toxic agent found by Link, *et al.*,[43] to be responsible for the hemorrhagic disease developing in cattle from eating spoiled clover hay, interferes with the production of prothrombin in the liver. It has no action on the clotting mechanism directly. The action on the prothrombin time is delayed 48 hours after the drug is started while the circulating prothrombin is removed from the blood. This action is opposed by certain naphthoquinones, the so-called vitamins K,[44] which are useful in combating overdose with dicoumarol. Heparin is the name given to a group of substances having an antithrombin action. It is given in doses of 50 to 100 units intravenously to adults, acting immediately to prolong the clotting time. Its action is brief and inconstant, because of excretion and inactivation, and the dose must be repeated every three hours. By giving it subcutaneously in a suitable menstruum the absorption can be delayed and only one dose per day is required. Dicoumarol is given in doses of 200 to 300 mg. by mouth, providing the prothrombin time is normal before treatment is begun. Later, doses are given according to the prothrombin time, which should be maintained between 20 to 35 per cent. In venous sinus and jugular vein thrombosis, when anticoagulant therapy is indicated, heparin and dicoumarol are started together. The heparin is continued until the dicoumarol begins to have its effect, usually at the end of 48 hours.

Dicoumarol is similar to the salicylates, and can be synthesized from them. The latter have been found to have a weak antiprothrombin action, especially aspirin.[45] There are numerous conflicting reports in the literature of the frequency of late tonsillar hemorrhage due to the salicylates.[46, 47] The final answer has not been found. If the salicylates have any rôle in the production of late tonsillar hemorrhage, this difficulty can easily be prevented by the administration of vitamin K The usual dose is 5 to 10 mg by mouth or parenterally

The most perplexing and important disorders are those due to the capillaries Vitamin C deficiency probably has very little importance in tonsillar hemorrhage, as is supposed by some[48] Rutin, a derivative of flavone and closely related to hesperdin (vitamin P), citrin and ascorbic acid, is obtained from buckwheat leaves, flowers, tobacco, rue herb and many other plants It has been shown to reduce capillary permeability when artificially induced in animals,[49] and in man in a variety of pathologic conditions[50] It has caused a halt in the progress of retinal changes in patients with diabetic retinopathy, but has not corrected any of the existing damage[51] It has also been of benefit in the treatment of epistaxis in some patients with hereditary hemorrhagic telangiectasis[52] It seems worthwhile to try it, in doses of 50 to 100 mg per day, with 100 to 200 mg of vitamin C in capillary disorders with hemorrhage

FOLIC ACID AND VITAMIN B_{12}

The name Folic Acid was given by Mitchell, *et al* to an extract of spinach found to be necessary for the growth of str fecalis[52] It is now used to refer to the group of pteroylglutamic acids with similar hematopoietic activity found in nature and synthesized This extract of spinach is essentially similar to the L casei factor obtained from yeast,[53, 54] the vitamin B extracted from liver necessary for the prevention of pancytopenia and retarded growth in chicks,[53-55] and the vitamin M necessary to prevent a sprue-like syndrome with pancytopenia in monkeys fed a synthetic diet containing all the known essential nutritive elements It has been synthesized by Waller, *et al*, who found it to contain para amino benzoic acid, glutamic acid, and a pterin nucleus related to the yellow pigment found in butterfly wings

The daily requirements of this vitamin have not been determined, but the amount present in the normal diet is much less than the amount required therapeutically A great many bacteria produce this vitamin, and it may be that part of the

The prothrombin time as measured by the method of Quick is a chemical determination of the prothrombin activity It is important to remember that prothrombin combines with thromboplastin and that if prothrombin is deficient, clotting will not occur or will be defective The hemorrhagic danger level is indicated by a prothrombin time of 25 seconds, which corresponds to a prothrombin activity of 20 per cent Dicoumarol, the toxic agent found by Link, *et al*,[13] to be responsible for the hemorrhagic disease developing in cattle from eating spoiled clover hay, interferes with the production of prothrombin in the liver It has no action on the clotting mechanism directly The action on the prothrombin time is delayed 48 hours after the drug is started while the circulating prothrombin is removed from the blood This action is opposed by certain naphthoquinones, the so-called vitamins K,[44] which are useful in combating overdose with dicoumarol Heparin is the name given to a group of substances having an antithrombin action It is given in doses of 50 to 100 units intravenously to adults, acting immediately to prolong the clotting time Its action is brief and inconstant, because of excretion and inactivation, and the dose must be repeated every three hours By giving it subcutaneously in a suitable menstruum the absorption can be delayed and only one dose per day is required Dicoumarol is given in doses of 200 to 300 mg by mouth, providing the prothrombin time is normal before treatment is begun Later, doses are given according to the prothrombin time, which should be maintained between 20 to 35 per cent In venous sinus and jugular vein thrombosis, when anticoagulant therapy is indicated, heparin and dicoumarol are started together The heparin is continued until the dicoumarol begins to have its effect, usually at the end of 48 hours

Dicoumarol is similar to the salicylates, and can be synthesized from them The latter have been found to have a weak antiprothrombin action, especially aspirin[45] There are numerous conflicting reports in the literature of the frequency of late tonsillar hemorrhage due to the salicylates[46,47] The final answer has not been found If the salicylates have any rôle in the production of late tonsillar hemorrhage, this difficulty can easily be prevented by the administration of vitamin K The usual dose is 5 to 10 mg by mouth or parenterally

The most perplexing and important disorders are those due to the capillaries Vitamin C deficiency probably has very little importance in tonsillar hemorrhage, as is supposed by some[48] Rutin, a derivative of flavone and closely related to hesperidin (vitamin P), citrin and ascorbic acid, is obtained from buckwheat leaves, flowers, tobacco, rue herb and many other plants It has been shown to reduce capillary permeability when artificially induced in animals,[49] and in man in a variety of pathologic conditions[50] It has caused a halt in the progress of retinal changes in patients with diabetic retinopathy, but has not corrected any of the existing damage[51] It has also been of benefit in the treatment of epistaxis in some patients with hereditary hemorrhagic telangiectasis[52] It seems worthwhile to try it, in doses of 50 to 100 mg per day, with 100 to 200 mg of vitamin C in capillary disorders with hemorrhage

FOLIC ACID AND VITAMIN B_{12}

The name Folic Acid was given by Mitchell, *et al*, to an extract of spinach found to be necessary for the growth of str fecalis[52] It is now used to refer to the group of pteroylglutamic acids with similar hematopoietic activity found in nature and synthesized This extract of spinach is essentially similar to the L casei factor obtained from yeast,[53] [illegible] the vitamin B extracted from liver necessary for the prevention of pancytopenia and retarded growth in chicks,[53-5] and the vitamin M necessary to prevent a sprue-like syndrome with pancytopenia in monkeys fed a synthetic diet containing all the known essential nutritive elements It has been synthesized by Waller, *et al*, [illegible] who found it to contain para amino benzoic acid, glutamic acid, and a pterin nucleus related to the yellow pigment found in butterfly wings

The daily requirements of this vitamin have not been determined, but the amount present in the normal diet is much less than the amount required therapeutically A great many bacteria produce this vitamin, and it may be that part of the human requirement is derived thus.[57] There are no known deficiency states of folic acid, but the important symptoms that can be relieved by treatment with it are pancytopenia, retarded growth and gastrointestinal disturbances. Folic acid has proven effective in the treatment of the hematopoietic phase of Addisonian pernicious anemia, nutritional macrocytic anemia and neutropenia, and the macrocytic anemia of infancy and pregnancy, and following gastric resection.[58] There are no anemias responsive to folic acid that do not respond to liver extract. The action of liver extract in Addisonian pernicious anemia is to convert the conjugated form of folic acid, as it appears in the diet, into the active free form. Thus free folic acid when given directly does not need liver extract to be effective.[8] Folic acid does not reverse or prevent the neurological manifestations of Addisonian pernicious anemia, and may even precipitate their appearance in patients showing a good hematological response.[59] Other experimental studies also indicate a general fundamental rôle of folic acid in the human in addition to its effect on hematopoiesis.[60] It has been shown to increase the resistance of animals to strep and influenza infection as compared to animals not receiving it.[61] The results in treating aplastic anemia have been too variable to be conclusive, but folic acid is not curative. Thus pernicious anemia seems to be a multiple deficiency disease. Folic acid is capable of correcting the hematopoietic but not the neurological deficiencies. For this reason "the use of folic acid alone in the treatment of these cases is at present not recommended."[58] The usual therapeutic dose is 10 mg. per day by mouth, and 5 to 10 mg. per day as a maintenance dose.[58] If the disease doesn't respond in two weeks, it is probably not due to a folic acid deficiency. There is reason to believe that the larger doses, while not being more beneficial, may even precipitate the appearance of neurological disturbances.

The isolation from liver extract of a very potent antipernicious anemia factor, vitamin B_{12}, was carried out by Rickes, *et al.*[62] It was demonstrated by Shorb to promote the growth of L. casei.[63] This pure crystalline product seems to be the long sought active principal of liver extract It is active when taken orally alone, more active when combined with gastric juice, and most active when taken parenterally, in each instance resembling liver extract[64] Doses as small as 5 to 25 micrograms have caused a clinical and hematological response in two cases of pernicious anemia, two cases of nutritional macrocytic anemia, and one case of nontropical sprue[65] More recently, responses have been reported in cases of tropical sprue[66] and combined system disease[67] This last patient was allergic to beef and hog extracts but had no untoward reaction to treatments with vitamin B_{12} The advantages of potency, effectiveness against all the manifestations of the disease, ease of administration and absence of allergic properties make vitamin B_{12} the drug of choice in the treatment of macrocytic anemia Until it becomes available, it is best to use a potent liver extract, with or without folic acid

SUMMARY

The advances in hematology of interest to the otolaryngologists in the last four years are presented The epidemics of infectious mononucleosis during and since the war have increased the importance of this disease, so a brief review of it is presented The blood fractions have been made available for assisting coagulation, preventing or attenuating infection and many other uses Chemical agents are now available for the treatment of leucemia and lymphoma, the most important of which is nitrogen mustard Two new products have been obtained from spinach and liver, folic acid and vitamin B_{12}, respectively, which are very powerful in the treatment of macrocytic anemia and related conditions In addition, there have been advances in the understanding of the coagulative process and the diseases associated with it The implication of many of the commonly used drugs in the development of hypoplasia of the marrow in varying degree makes it important that the potential danger of these drugs be understood

BIBLIOGRAPHY

1 Van den Berghe, L, and Liessens, P Transmission of Human Infectious Mononucleosis (Glandular Fever of Pfeiffer) to Maccus Rhesus and Successive Passages of a Filterable Virus *Comp Rend Soc de Biol* 130 279, 1942

2 Contratto, A W Infectious Mononucleosis *Arch Int Med* 73 449 1944

3 Tidy, H L Glandular Fever and Infectious Mononucleosis *Lancet* 2 180 236, 1934

4 Custer, R P, and Smith, E B The Pathology of Infectious Mononucleosis *Blood*, 3 8 830, 1948

5 Vaughan, S L, and Regan, J S Infectious Mononucleosis Complicated by Spontaneous Rupture of the Spleen and Central Nervous System Involvement *Blood*, 1 334, 1946

6 DeMarsh, Q B, and Alt, H L Hepatitis Without Jaundice in Infectious Mononucleosis *Jour Lab and Clin Med* 32 320, 1947

7 Lloyd, P C Acute Thrombocytopenic Purpura in Infectious Mononucleosis *Amer Jour Med Sci*, 207 670, 1944

8 Allen, F H, and Kellner, A Infectious Mononucleosis — An Autopsy Report *Amer Jour Pathol*, 23 463, 1947

9 Kaufman, B Methionine in Control of Bleeding and Restoration of Normal Clot Retraction in Purpura Following Scarlet Fever Report of Two Cases *Arch Pediat*, 63 382 390, 1946

10 Warren, H D, Ragliand F T and Potsubay S F Thrombocytopenic Purpura Following Rubella *Med Clin N Amer* 30 401-404 1946

11 Cohen, J, and Bansmer, C Chicken Pox with Simultaneous Idiopathic Thrombocytopenic Purpura *N Eng Jour Med* 237 7, July 14 1947

12 Davis, W C, and Saunders, T S Purpura Due to Iodides Report of a Case *Arch Dermat and Syph*, 53 644, 1946

13 Nadelman, P L Thrombocytopenic Purpura Following Quinidine *Jour A M A*, 137 14, July 31 1948

14 Carnicelli, T and Fedeschi C Fatal Acute Pancytopenia Following Tridione Treatment *N Eng Jour Med*, 238 10 Mar 4 1948

15 Custer, R P Aplastic Anemia in Soldiers Treated with Atabrine (Quinicrine) *Amer Jour Med Sci*, 212 211 224, 1946

16 Gibson, J D II, Evans, R D, Aub J C, Sack, T and Peacock W C Posttransfusion Survival of Preserved Human Erythrocytes Stored as Whole Blood, or in Resuspension After Removal of Plasma by Means of Two Isotopes of Radioactive Iron *Jour Clin Invest* 26 715 738 1947

17 Bailey, O T, *et al* Human Fibrin Foam with Thrombin as a Hemostatic Agent in General Surgery *Surg*, 18 347 369 1945

18 Schenck, H P Use of Products of Fibrinogen and Thrombin in Otolaryngology *Calif and West Med*, 63 80 1945

19 Jenkins, H P and Clarke J S Gelatin Sponge a New Hemostatic Substance *Arch Surg*, 51 253 262 1945

20 Frantz, U K., Clarke, H T and Lattes R Hemostasis with Absorbable Gauze Oxidized Cellulose *Ann Surg*, 120 181 198 1944

21 Fox, S L The Use of Thrombin in Rhinologic Surgery The Laryngoscope, LVI 2 48 53, 1944

22 Cronkhite E P, Lozner, E L, and Deaver J M The Use of Thrombin and Fibrinogen in Skin Grafts *Jour A M A*, 124 976 987 1944

23 MINOT G R, *et al* The Coagulative Defect in Hemophilia The Effect in Hemophilia of the Parenteral Administration of a Fraction of the Plasma Globulins Rich in Fibrinogen *Jour Clin Inves*, 24 704 793 1945

24 JANEWAY, C A Clinical Use of the Products of Human Plasma Fractionation I—Albumin in Shock and Hypoproteinemia III—Gamma Globulin in Measles *Jour A M A* 126 674 680 Nov 11 1944

25 HAVENS, W P, JR, and PAUL, J R Prevention of Infectious Hepatitis with Gamma Globulin *Jour A M A*, 129 270 272, Sept 22 1945

26 MCGUINNESS, A C, PETERS, M and GELLIS S S A Study on the Prevention of Mumps Orchitis by Gamma Globulin *Amer Jour Med Sci* 210 661 1945

27 BLANCHARD, M C and STOKES, J JR, *et al* II—The Inactivation of Hepatitis Virus SH (Homologous Serum Jaundice) with Ultraviolet Irradiation *Jour A M A*, 138 341 343 1948

28 KRUMBHAAR, E B Rôle of the Blood and Bone Marrow in Certain Forms of Gas Poisoning *Jour A M A*, 72 39 1919

29 GILMAN, A., and PHILLIPS F S The Biologic Actions and Therapeutic Applications of the B Chlorethyl Amines and Sulfides *Sci* 103 409 415 1946

30 GOODMAN, L S, WINTROBE, M M DAMESHEK, W GOODMAN, M J GILMAN, A. and MCLENNAN, M T Nitrogen Mustard Therapy *Jour A M A*, 133 126 1946

31 JACOBSON L O *et al* Nitrogen Mustard Therapy Studies on the Effect of Methyl Bis (Beta Chlorethyl) Amine Hydrochloride on Neoplastic Diseases and Allied Disasters of the Hematopoietic System *Jour A M A*, 132 263 1946

32 KARNOFSKY D A *et al* An Evaluation of (Nitrogen Mustards) NH_2 and Tris (Chlorethyl) Amine Hydrochloride in the Treatment of Lymphoma Leucemia and Allied Diseases Approaches to Tumor Chemotherapy *Amer Assn for the Advancement of Sci* p 319 Washington D C 1947

33 THOMAS, M I R and CULLUMBINE, H Nitrogen Mustards in Hodgkins Disease *Lancet*, 1 899 1947

34 WINTROBE, M M, *et al* Nitrogen Mustard Therapy in Hodgkins Disease Lymphosarcoma and Leucemia *Ann Int Med* 27 529 1947

35 HADDON, A. and SEATON, W A Influence of Carbamic Esters (Urethane) on Experimental Animal Tumors *Nature* 157 500 1946

36 PATERSON, E HADDON A. THOMAS I A and WATKINSON J M Leucemia Treated with Urethane *Lancet*, 250 677 1946

37 SPIES T D Experiences with Folic Acid Chicago Year Book Pub Inc 1947

38 FARBER, S, *et al* Action of Pteroylglutamic Conjugates on Man *Sci* 106 619 621 1947

39 FARBER S *et al* Temporary Remissions in Acute Leucemia in Children Produced by Folic Acid Antagonists 4 Amino Pteroylglutamic Acid (Aminopterin) *N Eng Jour Med* 238 23 June 1948

40 REINHARD E H MOORE, C V BIERBAUM O S and MOORE S Radioactive Phosphorus as a Therapeutic Agent *Jour Lab and Clin Med* 31 107 1946

41 HOWELL W H Theories of Blood Coagulation *Physiol Rev* 15 435 470 1935

42 QUICK A J HONORATO R and STEFANINI M The Value and Limitations of the Coagulation Time in the Study of Hemorrhagic Diseases *Blood* III 10 1120 1129 1948

43 LINK, K P The Anticoagulant from Spoiled Sweet Clover Hay Harvey Lectures, 39 162 216, 1943 1944

44 DAM, H Vitamin K Its Chemistry and Physiology Advances in Enzymology 2 285 324, 1942

45 FERGUSON, J H Mechanism of Blood Coagulation *Amer Jour of Med*, 111 1 67 78, 1947

46 NIEVERT, H, *et al* Late Secondary Tonsillar Hemorrhage Studies of Prothrombin and Vitamin K *Arch Otolaryngol*, 42 1 14 July, 1947

47 FOX, S L, and WEST, G B Vitamin K and Late Tonsillar Hemorrhage THE LARYNGOSCOPE, LVII 8 564, Aug 1947

48 NIEVERT, H, *et al* Late Secondary Tonsillar Hemorrhage II—Studies of Ascorbic Acid *Arch Otolaryngol*, 43 6 568, 1946

49 AMBROSE, A M *et al* The Protective Action of Rutin Against Capillary Injury *Fed Proc*, 6 306, 1947

50 SHANNO, R L Rutin New Drug for Treatment of Increased Capillary Fragility *Amer Jour Med Sci*, 211 539 543, 1946

51 LEVITT, L M Rutin Therapy for Increased Capillary Fragility and Retinopathy Associated with Diabetes Mellitus *Amer Jour Med Sci*, 215 130 136, Feb, 1948

52 MITCHELL, H K, *et al* Concentration of "Folic Acid" *Jour Amer Chem Soc*, 63 2284, 1941

53 BERRY, L J, and SPIES, T D Present Status of Folic Acid *Blood*, 1 271 306, 1946

54 CARTWRIGHT, G E Dietary Factors Concerned in Erythropoiesis *Blood*, 2 111 153 and 256-297, 1947

55 PETERSON, W H The History of Folic Acid Factors *Ann N Y Acad Sci*, 48 257 260, 1946

56 WALLER, C W, *et al* Synthesis of Pteroylglutamic Acid (Liver L Casei Factor) and Pteroic Acid *Ann N Y Acad Sci*, 48 283 287 1946

57 WILLIAMS, R J *et al* Studies on the Vitamin Content of Tissues II Univ Tex Pub No 4237, Oct 1, 1942, 145 pp

58 SARGENT, F Medical Progress "Folic Acid' Pteroylglutamic Acid and Related Substances *N Eng Jour Med*, 237 18 667 672 and 237 19 703 707, 1947

60 Editorial Folic Acid (Pteroylglutamic) and the Antipernicious Anemia Factor in Liver *Jour A M A*, 137 13 1134, July 24, 1948

61 DOAN, C A The Cellular and Humoral Factors Influencing Constitutional Resistance and the Development and Control of Local Lesions THE LARYNGOSCOPE, LVIII 8 879, Aug, 1948

62 RICKES, E L *et al* Crystalline Vitamin B_{12}+ *Sci*, 107 396 1948

63 SHORB, M S Activity of Vitamin B_1 for Growth of Lactobacillus Lactis *Sci*, 107 397, 1948

64 BERK, L, and CASTLE, W B *et al* Observations on the Etiologic Relationship of Achylia Gastrica to Pernicious Anemia X Activity of Vitamin B_{12} as Food (Extrinsic) Factor *N Eng Jour Med*, 239 24 911 913, 1948

65 DARBY W T, *et al* The Influence of Pteroylglutamic Acid (a Member of the Vitamin M Group) on Gastrointestinal Defects in Sprue A Study of the Interrelationships of Dietary Essentials *Jour Nutrition* 34 645, 1947

66 SPIES, T D, *et al* Observations on the Hematopoietic Response of Persons with Tropical Sprue to Vitamin B_{12} *South Med Jour* 41 527 1948

67 BERK L, DENNY BROWN D FINDLAND M and CASTLE W B Effectiveness of Vitamin B_{12} in Combined System Disease *N Eng Jour Med* 239 328 330 1948

PSYCHOSOMATIC ASPECTS OF DISEASES OF THE EAR, NOSE AND THROAT *

LESTER D COLEMAN M D ,
New York, N Y

INTRODUCTION

The interrelationship between emotional experiences and physiologic processes is no longer a speculative one This relationship is now accepted as a tangible and concrete factor in the perception of disease The influence of emotional variations on body functions has been recognized and studied with interest in every phase of medicine The alteration of clinical symptomatology by psychic factors has been repeatedly witnessed by us as otolaryngologists To underestimate the importance of these psychosomatic factors in otolaryngology is to do a great injustice to our patients and ourselves as surgeons

A psychic and somatic relationship may infer a feeling of separation Rather do I mean to identify each as a stratification of the other This, then converts the psyche and the soma from a dissociated duality into a dominant unity

It is my purpose to present some of the aspects of this body-mind unity as applied to practical otolaryngology and particularly to show how they affect medical and surgical results

In accepting this orientation it might be wise to re-examine one fundamental question namely, what is illness? If we are agreed that illness is a phase during which an individual is unable to be serviceable to himself, to his family, his community and to his earning occupation, then the cause of that illness must be our chief concern, whether its origin is psychic, organic or both The patient's serviceability is limited, whether his illness is due to a fractured leg or to an acute anxiety Hostilities, insecurities and anxieties are just as significant manifestations of pathology as are pain and tenderness The responsibility of the physician, therefore, is to re-establish this lost serviceability and to rehabilitate the patient organically and psychically

How do we as otologists fit into the complex structure of Psychosomatic Medicine? I should say that our responsibility is twofold First, we must devote ourselves to eliminating, in our young patients, those traumatic experiences which may lead to adult neuroticisms Second, we must re-evaluate our concept of organic disease and interpret it in terms of the personality

I have arbitrarily chosen a discussion of tonsillectomy to emphasize the contribution we can make in avoiding psychic trauma in childhood Tonsillectomy is by far the most common single operative experience of childhood So common in its universality, in fact, that we have ceased to recognize its portent and effect on the future destiny of the child In most cases, tonsillectomy represents the first admission of the child to a hospital and in most instances is the first painful separation of the child from his home and security Let us for a moment trace the usual preoperative and postoperative story

The child is brought to the office of the otolaryngologist, who sincerely tries to develop a pleasant relationship with his patient Tonsillectomy is advised, the date is arranged and the experience is set Except in those few cases where parents are attuned to the importance of careful psychological preparation, a great injustice is done to the child A composite story reveals that the child is told that on a certain day he can anticipate a pleasant and new experience Instead of that, he finds himself on that day suddenly confined, by a "clever" ruse, to a hospital room far removed from the scene of his anticipated joy Strange, serious, white-robed people are milling about him He is almost immediately undressed, emphasizing his "capture" It is difficult to comprehend the impact of such terror and confusion, and to evaluate its disastrous sequelae There is, first, the immediate resentment at having been lied to and tricked into this situation Then there is the distrust of the child for the parent, which distrust may in one moment negate all the protection and support previously given Unfortunately the parents are least equipped at this time to give solace and comfort, and usually cannot help but transmit their own apprehension and concern to the child Without warning, one or two persons, the operating room attendants or nurses, gentle and kind, but at best strangers, pick up the struggling child and whisk him away to an unknown destiny

Can we project ourselves into the terrifying moment when first the child enters the strange, white-walled, instrument-filled operating room? Before he can accommodate himself to this picture, a new terror descends upon him for he is now overpowered and restrained, anesthesia begun Do we who have witnessed this struggle adequately appraise the profound effect which this moment of terror has upon the impressionable child? He leaves his conscious state aware that his parents have deserted him There is a shattering loss of faith in parental protection and complete distrust of their motives The struggle between the conscious and the unconscious during the early stages of anesthesia is tantamount to dying It is ironic that at this very moment the orderly usually feels personally insulted when the child refuses to take it lying down!

The immediate or delayed reaction to this relatively simple surgical procedure may be alterations in behavior, family antagonisms, negativisms, night terrors, hostilities, phobias, obsessions and other psychoneurotic patterns For us, a most important consequence may be the lifelong fear and distrust of doctors, hospitals, anesthesia and surgery At best, even with the most careful preparation, this experience is far from a pleasant one, but we can attenuate the trauma by the proper handling of the child and the parent Many of us feel that our chief obligation is to remove the tonsils, and that the future happiness of these children is not within our surgical province Yet, that responsibility is more distinctly ours as we become aware of our important position in the psychosomatic approach

I should like to suggest a few steps that might be taken to obviate the psychological pitfalls of tonsillectomy

1 Give the child a forthright and honest explanation of the reasons for the operation

2 Try to avoid the element of surprise and confusion at the hospital A recognizable picture of the hospital, the operating room, white-gowned nurses and doctors should be described

3 Explain that the purpose of anesthesia is to spare the child pain during the operation Assurance must be given that this forced sleep is temporary and will be followed by complete awakening and survival The ideal anesthetic is one chosen for surgical efficiency and psychic consideration

4 Emphasize to the parents the need for constant reassurance and affection in the postoperative period

5 Whenever possible, the doctor personally should lead the child from the mother to the operating room The previously established child-doctor rapport here pays dividends in the sustained security

6 Permit overt manifestation of postoperative hostility, rather than suppress it The psychic damage of such suppressions is fraught with subsequent danger

This realistic portrayal of the emotional aspects of a tonsillectomy is not meant to be pessimistic or foreboding Nor is it meant to condemn a most efficacious and health restoring procedure I mean only to illustrate that adult neuroticisms may be traced to such experiences Often it remains for the expert, the psychoanalyst, to uncover such a basis for fears, rejection and insecurities

Let me re-emphasize that I do not mean to negate the value of a tonsillectomy because of potential psychic trauma Rather do I want to consider psychic trauma as another pre- or post-operative problem to be avoided as we would hemorrhage or infection By our very awareness of its potentialities we may make an intrinsically unpleasant experience less so, psychically and somatically This, too, is a great surgical contribution

I should like now to devote myself to the second of the two classifications, the interpretation of organic disease in terms of the personality

The following subgrouping is a useful though superficial one for psychosomatic identification

Group One consists of — The estimated one-third of all patients who do not have any definite bodily disease to account for their symptoms, illness or incapacitation

Group Two consists of — The established one-third of patients whose symptoms are in part dependent on emotional factors Psychic elaboration of the complaints add materially to the morbidity and disability

Group Three consists of — The last one-third, a group with great diversification In this group might be included migraine, asthma, hypertension, duodenal ulcer, nonspecific ulcerative colitis and Graves' disease Organic disease is present Psychic disturbances are a significant etiologic factor in the production of vegetative nervous system diseases

The management of that vast group in which no organic pathology is found is exceedingly difficult We can with relative ease dismiss the patient s complaints by stating that no disease is present, but this method does not eliminate the symptoms or the unserviceability and is fraught with potential danger These patients may eventually find someone who with the most careful preparation, this experience is far from a pleasant one, but we can attenuate the trauma by the proper handling of the child and the parent Many of us feel that our chief obligation is to remove the tonsils, and that the future happiness of these children is not within our surgical province Yet, that responsibility is more distinctly ours as we become aware of our important position in the psychosomatic approach

I should like to suggest a few steps that might be taken to obviate the psychological pitfalls of tonsillectomy

1 Give the child a forthright and honest explanation of the reasons for the operation

2 Try to avoid the element of surprise and confusion at the hospital A recognizable picture of the hospital, the operating room, white-gowned nurses and doctors should be described

3 Explain that the purpose of anesthesia is to spare the child pain during the operation Assurance must be given that this forced sleep is temporary and will be followed by complete awakening and survival The ideal anesthetic is one chosen for surgical efficiency and psychic consideration

4 Emphasize to the parents the need for constant reassurance and affection in the postoperative period

5 Whenever possible, the doctor personally should lead the child from the mother to the operating room The previously established child-doctor rapport here pays dividends in the sustained security

6 Permit overt manifestation of postoperative hostility, rather than suppress it The psychic damage of such suppressions is fraught with subsequent danger

This realistic portrayal of the emotional aspects of a tonsillectomy is not meant to be pessimistic or foreboding Nor is it meant to condemn a most efficacious and health restoring procedure I mean only to illustrate that adult neuroticisms recognized, removed and the patient cured More often, despite persistent local therapy, no alteration of the character or severity of the tinnitus occurs The frequently associated hearing impairment adds to the emotional burden

The psychic component of tinnitus is considerable The distress of tinnitus may be due to these psychic equivalents Tinnitus has a strange mystic quality — persistent, and strangely foreboding to the patient To many it connotes a brain tumor, eventual deafness or an impending stroke This is indeed a triple threat to the emotional balance of a sensitive human being Constant reassurance and explanation may not reduce the intensity of the tinnitus, but may teach the patient to neglect its annoyance and to live without thought of impending calamity Where this approach is ineffectual, psychotherapy may often be essential to prolong serviceability

CASE REPORT

A patient G R age 48 with a menopausal syndrome presented herself with tinnitus A mild associated hypertension was the only finding of significance Inquiry revealed an anxious unstable personality whose distress from tinnitus varied with fatigue and emotional upheavals An interesting subjective note was that she felt her emotional upheavals were precipitated by an increase in the intensity of the tinnitus

The cycle of tinnitus and emotion kept repeating with increasing intensity and frequency until the two factors were indistinguishable A physician nephew denied that psychotherapy rather than tubal inflation was the conservative therapy of choice My suggestion was met with personal hurt and anger at the insinuation that a psychoneurotic lurked in the family closet I am told that tubal inflation was performed on the very day that the patient was found a suicide in the Hudson River

Education which teaches that neurosis is no greater shame than mastoiditis must be instituted Consultation between otologists and psychotherapists might have preserved a serviceable human being

Cosmetic surgery offers another illustration The complete personality alteration with new happiness and accomplishment has been gratifying to us following successful nasal reconstruction None can deny the joy of the rehabilitated personality when social success accompanies a fine surgical result but often after an apparently finely performed operation the patient returns with cosmetic complaints Many who are at will treat this functional ailment by quasisomatic therapy The concomitant pitfalls are apparent We can achieve better results with this group by referring them to psychotherapy, but not as a punishment for our therapeutic failure Kindness, teaching and patience will introduce them to psychotherapy where other methods fail Unfortunately there is a great resistance on the part of many persons to admit the need for psychotherapy This stigma must be eradicated by re-education if we are to achieve effective therapy

The second group, in which both organic and psychic factors present themselves, most frequently confronts the otolaryngologist

In our routine office experience we are often faced with the disparity between the apparent severity of the symptoms and the organic findings We have all noted the severe depression and melancohlia associated with suppurative disease of the sphenoids and antra We, too, have seen the transition to relative normal emotional behavior when the congested nose and the infection have subsided Personality variations with severe emotional instability have been noted as a concomitant to accessory sinus disease, especially with involvement of the frontal sinuses All intermediate stages from mild emotional crises to uncontrolled neuroses and even psychoses have been reported

In many cases, somatic therapy alone is disappointing Particularly is it so when incapacitating symptoms persist though the infection subsides Psychotherapy as an adjunct to somatic therapy is the ideal approach

The problem of tinnitus is a universal one A patient frequently presents himself with only tinnitus as the disturbing symptom Just as the character and the intensity of the noise may vary, so may the distress — from mild annoyance to manic or even suicidal proportion Routine investigation seeks the etiology in hypertension, cardiovascular disturbances, endocrine disturbances, and in local pathology in the ears, nose or nasopharynx Occasionally the pathology is recognized, removed and the patient cured More often, despite persistent local therapy, no alteration of the character or severity of the tinnitus occurs The frequently associated hearing impairment adds to the emotional burden

The psychic component of tinnitus is considerable The distress of tinnitus may be due to these psychic equivalents Tinnitus has a strange mystic quality — persistent, and strangely foreboding to the patient To many it connotes a brain tumor, eventual deafness or an impending stroke This is indeed a triple threat to the emotional balance of a sensitive human being Constant reassurance and explanation may not reduce the intensity of the tinnitus, but may teach the patient to neglect its annoyance and to live without thought of impending calamity Where this approach is ineffectual, psychotherapy may often be essential to prolong serviceability

CASE REPORT

A patient, G R. age 48 with a menopausal syndrome presented herself with tinnitus A mild associated hypertension was the only finding of significance Inquiry revealed an anxious unstable personality whose distress from tinnitus varied with fatigue and emotional upheavals An interesting subjective note was that she felt her emotional upheavals were precipitated by an increase in the intensity of the tinnitus

The cycle of tinnitus and emotion kept repeating with increasing intensity and frequency until the two factors were indistinguishable A physician nephew denied that psychotherapy rather than tubal inflation was the conservative therapy of choice My suggestion was met with personal hurt and anger at the insinuation that a psychoneurotic lurked in the family closet. I am told that tubal inflation was performed on the very day that the patient was found a suicide in the Hudson River

Education which teaches that neurosis is no greater shame than mastoiditis must be instituted Consultation between otologists and psychotherapists might have preserved a serviceable human being

Cosmetic surgery offers another illustration The complete personality alteration with new happiness and accomplishment has been gratifying to us following successful nasal reconstruction None can deny the joy of the rehabilitated personality when social success accompanies a fine surgical result but often after an apparently finely performed operation the patient returns with cosmetic complaints Many who are at first delighted with the result now insinuate that the surgery was unsuccessful For them it was, because the anticipated social rebirth was never realized Such failures can be obviated by judicious inquiry into the emotional history of the patient Preoperatively, it is imperative for us to recognize the personalities so steeped in insecurity that even an excellent surgical result will not eliminate factors of maladjustment Such patients are not in complete harmony with their existing status Ofter such a patient will attribute to her misshapen nose her physical frustrations, her inability to marry and her relatively poor social or professional position Having chosen to blame their misfortunes on a cosmetic defect, they plan and save for a plastic repair, sometimes investing their entire faith in the outcome

To possess a reason for failure is comforting, to be deprived of it is disastrous

Thus when the nasal plastic does not bring social success, and personality satisfaction, the patient is left with two alternatives She must either begin to face her psychological inadequacy or persist in the belief that her nasal defect is still responsible for her continued failure The choice she will inevitably make is obvious To readily admit the need for psychotherapy, as we have previously noted, is painful and self-stigmatizing, therefore do we encounter the frequent demands for revised cosmetic surgery

CASE REPORT

I M, aged 30, the eldest daughter of a motherless home enthusiastically submitted to a nasal plastic I was consulted seven months later by the patient, her father and brother The patient felt that the previous operation was not successful and for her it was not for it did not fulfill her social hopes though to an objective observer the nose was straight and cosmetically pleasant

Suggested psychotherapy might not have been so readily rejected had not a second surgeon promised relief by revised surgery I have traced this story through three successive operations to culminate in a manic phase controlled by strait jacket in the office of the fourth

Elective surgery is denied those who are considered poor surgical risks Cardiac insufficiency and kidney dysfunction would deter us from elective cosmetic surgery Even in non-selective surgery we await their optimum condition before operation So must the emotionally unstable, the frustrated, anxious neurotic personality be included as a psychically poor surgical risk Better orientation and integration must be awaited and established, preoperatively Cosmetic surgery performed without recognition of emotional imbalance is fraught with danger and injustice to the patient, surgeon, and to an operation which is so very gratifying when well indicated

Another typical condition seen by otolaryngologists is that of hysterical aphonia Since there is no ordinary organic lesion to account for this laryngeal picture of bilateral adductor paralysis, it is diagnosed as an hysterical or functional ailment When this is determined, is it our responsibility to restore speech by any of the obvious methods of sudden fright or removal of a foreign body under general anesthesia, or is it more significant that we recognize this aphonia as just a local manifestation of a diffuse emotional disease? A symptomatic cure of hysterical aphonia without an adequate study of underlying causes, may do the patient a greater injustice than if left uncured Such cure of an hysterical aphonia serves to drive into the deeper recesses the etiological emotional factors responsible for the somatic representation That this hysterical symptom arises in response to an inner conflict or that this projection into illness is a flight from reality must be understood if a real cure is to be obtained by combined therapy Later manifestations of the same emotional disease may not be so easily recognized when once an apparent cure of hysterical aphonia is affected

CASE REPORT

accepted as a functional condition Only after the psychological involvement was recognized was psychotherapy instituted This was eventually responsible for the return of this girl to a perfectly normal existence She is once more serviceable to her child, home and community

Time permits me to mention but not to elaborate on many other otolaryngological conditions with psychogenic bases, or neurotic superstructures We need but mention the well investigated and established asthma-neurotic alliance Types of vertigo frequently identified as Ménière's or psuedo-Menière's disease may respond well to both psychic and somatic therapy The emotional responses of the laryngectomized patient can be traced from abysmal despair to reconciliation and eventual euphoria, under the kindly guidance and support of the psychotherapist The indefinable and incapacitating headache, whose origin in organic disease is not obvious, may well respond to combined therapy Such treatment should be employed long before somatic therapy alone has been determined as ineffective

The psychological elaborations of the deafened and the deaf are great Detailed study is now in preparation I need but recall the irritable, irascible and suspicious personality of the deafened The self-cloistering withdrawal from social activities is intimately tied up with these aberrations

There are many other conditions, of course, but one deserves more than superficial mention This is vasomotor rhinitis There are few diseases as emotionally distressing as vasomotor rhinitis This distress would seem to be disproportionate to the manifest local change in the nose Yet, the functioning capacity of the patient is at a minimum at such a phase

The causes are variously itemized as sensitivity to specific allergens, reaction to pregnancy and to menopause and the injudicious use of vasoconstrictor medications The nasogenital relationship has been noted by many observers The common denominator of most of these conditions is sympathetic-parasympathetic imbalance It is virtually impossible to dissociate any of these causes from either a psychogenic basis or a psychogenic implication In such a confused and indistinguishable cycle, one cannot determine whether the instability is the cause or result of the vasomotor change Case reports substantiating each are available

The correlation of history and symptoms will often reveal the approach likely to result in well-being Combined psychic and somatic therapy gives the greatest incidence of sustained results

CASE REPORT

A Spanish woman aged 30 presented a typical picture of vasomotor rhinitis of two years duration Allergic investigation revealed the sensitivity to dust followed by a protracted period of desensitization The patient spontaneously volunteered that her nose was most congested during episodes of emotional upheaval and extreme fatigue Her symptoms dated from the time she came to this country No other cause was established Local therapy including ionization and cauterization had been tried Benadryl during desensitization was entirely ineffectual The patient called to cancel an appointment because her husband had fallen and fractured his leg and had been removed to a hospital Three days after his hospitalization my patient presented herself at my office in great excitement There had been sudden relief from the nasal congestion This relief lasted until two days after her husband returned home The pathway led to the investigation of her home and family and revealed a bizarre emotional and physical existence with her husband She had married him three months before the onset of her symptoms Her husband was a confirmed and physically terrifying alcoholic When psychotherapy was instituted for the husband and his orientation established the relationship between the husband and wife improved There was a complete cessation of all symptoms referable to the nose This has persisted to date My only comment and not a facetious one is that this woman was emotionally allergic to her husband's personality

I must temper my enthusiasm for the psychosomatic approach with a warning Occasionally in the absence of obvious organic disease the patient is arbitrarily classified as functional, with the sad implication of "don't take too seriously Referrals from the badly named mental health department are often too casually inspected In the active run of the clinic, little time is permitted for mental carthasis with its personality revelations Hurried investigation has its dangerous posibilities We must not overlook organic pathology because the patient has been identified with a neurotic constitution

CASE REPORT

1943, the child became nauseated and vomited one morning The doctor felt that this was an excuse for not going to school Physical punishment thereafter followed each bout of vomiting The child was investigated psychometrically and was discharged from one of the leading institutions as a behavior problem There the psychologist noted "that he was of average ability but that emotional factors interfered with his efficiency The Rorschach pattern showed an extremely constricted boy whose mode of adjustment was introversive "

The persistent vomiting in the presence of chronic otitis media with vague neurological findings indicated further study When ventriculography was attempted a large parieto-occipital lobe abscess was evacuated

The exquisite balance between the psyche and the soma must be appreciated and maintained Our enthusiasm for one must not compromise the understanding of the other

May I point out that I do not mean to take a position with any school of interpretative analysis or psychotherapy I mean only to emphasize that the psychotherapist should be utilized by us as we would a cardiologist, dermatologist or any specialist in medicine for diagnostic and therapeutic aid Our recognition that a patient needs and deserves such an investigation may be the greatest step in his ultimate recovery Psychotherapy should not be resorted to only when all other approaches have failed Rather must it be employed in conjunction with well established somatic therapy We must be re-educated to identify pathology which might have both structural and functional complications Coupled with our diagnostic acumen, we must have a real interest in human beings as well as in human disease The physician and surgeon who is qualified to understand and treat psychosomatic illnesses must have as great an interest in psychobiology and psychopathology as he has in tissue pathology We must seek and find the psychic component in organic disease This component may be a causative factor in the production of the disease or may be an elaboration of the already established structural disease There can be no dissociation of the psyche and the soma if the individual is to be returned successfully to health and normal serviceability

162 East 80th Street

THE USE OF SODIUM PENTOTHAL ANESTHESIA IN ADULT TONSILLECTOMIES *

IRL H. BLAISDELL, M.D.,
Syracuse, N. Y.

In many parts of the country adult tonsillectomies are performed under local anesthesia, while in others some form of general anesthesia is used. In Syracuse, general anesthesia has long held sway, apparently only by weight of popular opinion, and it is with difficulty that a physician can persuade a patient to have his tonsils removed under local anesthesia. Each patient contemplating the procedure is almost certain to say, "I prefer to be asleep during the operation," or "I don't want to know what is going on."

In the early days of my practice, an adult tonsillectomy was often an arduous and time-consuming procedure and, occasionally, the better part of an hour was required for the induction of the anesthetic and the surgery. Invariably, the induction time for the anesthesia was at least 15 minutes. Ethyl chloride or nitrous oxide was used for the induction and followed by ether. Relaxation was always a questionable entity and occasionally "strong arm" methods were necessary to keep a husky and muscular male patient on the table.

At the close of the last war, younger members of our department of anesthesia returned to private practice with a knowledge and skill in handling intravenous pentothal for anesthesia. Most of these men had had wide experience with this anesthetic agent overseas and were quick to urge its use for a multitude of minor surgical procedures.

---

*Read at the meeting of the Middle Section, American Laryngological, Rhinological and Otological Society, Inc., Boston, Mass., Jan. 7, [illegible].

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 4, [illegible].

I discussed the possibilities of using sodium pentothal for adult tonsillectomy with them and found that at first the anesthetists were reluctant to advocate it, on the basis that laryngospasm with its undesirable sequelae was often produced Each one agreed, however, that if blood and secretions could be kept out of the hypopharynx and larynx, that this anesthetic agent might be used successfully Shortly after this conversation, five healthy football players were sent to us for tonsillectomies by the athletic department of Syracuse University All five were done the same morning under pentothal with no ill effects and without difficulty The total time for induction of anesthesia, and for the surgery for these five patients was slightly under two hours This marked the beginning of an era in the medical circles of our city The anesthetists and I were discussed, praised and condemned The use of sodium pentothal for anesthesia in adult tonsillectomy is not new A number of articles have appeared in both the British and American literature since 1942 Up to the present time, I would estimate that over 1,000 cases have been reported by various authors in the literature

In attempting to discuss sodium pentothal as an anesthetic agent, I am not unmindful of my own ignorance concerning this drug and its actions The details pertaining to the administration of pentothal I learned from Dr E Joseph Delmonico, the chief of the department of anesthesiology of the Syracuse Medical Center, who gave generously of his time and knowledge in the preparation of this paper During the past two years I have done 183 consecutive adult tonsillectomies under sodium pentothal The anesthesias have been carried out by the five anesthetists in the department of anesthesiology The patient ages varied from 13, the youngest, to 76 years, the oldest Laryngospasm did not occur Relaxation was complete and effective The time of induction of the anesthesia was shorter than any other type, in general, two to three minutes was the average time of induction There were no ill effects noted in any of the cases The indications and contraindications for sodium pentothal are much the same as for other surgical procedures with this anesthetic Moderately severe hypertension does not contraindicate its use inasmuch as the pressure drops somewhat under the anesthesia As for the technique of administration, our anesthetists use a 2 5 per cent solution, or between 200 and 300 mg Curare has been used occasionally to supplement the pentothal and to give additional relaxation of the head and neck, particularly in robust male patients For this purpose 20 to 40 units of curare are used It has not been found necessary to spray the throat with cocaine, pontocaine or any other anesthetic, nor has it been found necessary to infiltrate the tonsil area with procaine, however, the preoperative use of morphine and atropine, in appropriate dosage, it an important factor in maintaining a smooth anesthesia

Dr Ralph T Knight, of the department of anesthesiology of the University of Minnesota, recently said, "I have given a rather large number of anesthetics for tonsillectomy with sodium pentothal, curare and nitrous oxide and I believe it to be the very best form of anesthesia for the purpose All patients are intubated as soon as induced We mix the pentothal with d-tubo-curarine so that each cubic centimeter of solution contains 25 mg of pentothal and five units (0 75 mg) of tubo-curarine Even the little children are given this anesthetic As soon as unconscious, they are given N_2O 65 per cent and O 35 per cent by mask, plus enough pentothal-curare until sufficiently relaxed to be intubated From then on, they received 500 cc each of N_2O O_2 per minute and just enough pentothal-curare to permit the surgery to be done They are awake almost as soon as the surgery is completed All patients are given a suitable dose of morphine and scopolamine one hour before surgery This cuts down the dose of pentothal-curare and makes for early awakening"

Pentothal has not been used in children under 12 to 13 years of age since they do not tolerate the drug well The most important single factor in the success of this anesthetic agent, in my opinion, is the position of the patient on the operating table It is my custom to use the Rose position with the head lowered about 30 degrees from the horizontal Blood

I discussed the possibilities of using sodium pentothal for adult tonsillectomy with them and found that at first the anesthetists were reluctant to advocate it, on the basis that laryngospasm with its undesirable sequelae was often produced Each one agreed, however, that if blood and secretions could be kept out of the hypopharynx and larynx, that this anesthetic agent might be used successfully Shortly after this conversation, five healthy football players were sent to us for tonsillectomies by the athletic department of Syracuse University All five were done the same morning under pentothal with no ill effects and without difficulty The total time for induction of anesthesia, and for the surgery for these five patients was slightly under two hours This marked the beginning of an era in the medical circles of our city The anesthetists and I were discussed, praised and condemned The use of sodium pentothal for anesthesia in adult tonsillectomy is not new A number of articles have appeared in both the British and American literature since 1942 Up to the present time, I would estimate that over 1,000 cases have been reported by various authors in the literature

In attempting to discuss sodium pentothal as an anesthetic agent, I am not unmindful of my own ignorance concerning this drug and its actions The details pertaining to the administration of pentothal I learned from Dr E Joseph Delmonico, the chief of the department of anesthesiology of the Syracuse Medical Center, who gave generously of his time and knowledge in the preparation of this paper During the past two years I have done 183 consecutive adult tonsillectomies under sodium pentothal The anesthesias have been carried out by the five anesthetists in the department of anesthesiology The patient ages varied from 13, the youngest, to 76 years, the oldest Laryngospasm did not occur Relaxation was complete and effective The time of induction of the anesthesia was shorter than any other type, in general, two to three minutes was the average time of induction There were no ill effects noted in any of the cases The indications and contraindications for sodium pentothal are much the same as for other surgical procedures with this anesthetic Moderately severe hypertension does not contraindicate its use inasmuch as the pressure drops somewhat under the anesthesia As for the technique of administration, our anesthetists use a 2 5 per cent solution, or between 200 and 300 mg Curare has been used occasionally to supplement the pentothal and to give additional relaxation of the head and neck, particularly in robust male patients For this purpose 20 to 40 units of curare are used It has not been found necessary to spray the throat with cocaine, pontocaine or any other anesthetic, nor has it been found necessary to infiltrate the tonsil area with procaine, however, the preoperative use of morphine and atropine, in appropriate dosage, it an important factor in maintaining a smooth anesthesia

Dr Ralph T Knight, of the department of anesthesiology of the University of Minnesota, recently said, "I have given a rather large number of anesthetics for tonsillectomy with sodium pentothal, curare and nitrous oxide and I believe it to be the very best form of anesthesia for the purpose All patients are intubated as soon as induced We mix the pentothal with d-tubo-curarine so that each cubic centimeter of solution contains 25 mg of pentothal and five units (0 75 mg) of tubo-curarine Even the little children are given this anesthetic As soon as unconscious, they are given N_2O 65 per cent and O 35 per cent by mask, plus enough pentothal-curare until sufficiently relaxed to be intubated From then on, they received 500 cc each of N_2O O_2 per minute and just enough pentothal-curare to permit the surgery to be done They are awake almost as soon as the surgery is completed All patients are given a suitable dose of morphine and scopolamine one hour before surgery This cuts down the dose of pentothal-curare and makes for early awakening"

Pentothal has not been used in children under 12 to 13 years of age since they do not tolerate the drug well The most important single factor in the success of this anesthetic agent, in my opinion, is the position of the patient on the operating table It is my custom to use the Rose position with the head lowered about 30 degrees from the horizontal Blood and secretions then gravitate to the nasopharynx and with the use of the Davis-Crowe type of mouth gag, the hypopharynx can be constantly observed and the airway kept free of blood and mucus To do a tonsillectomy on an adult under pentothal in the horizontal or sitting positions is an invitation to disaster — a fact which was amply demonstrated by several of my colleagues It is also important that the surgeon and anesthetist avoid cyanosis For this reason, a flow of oxygen into the patient's mouth, along the blade of the mouth gag, is used These observations of mine coincide closely with those of other men who have used pentothal for tonsillectomy and written upon this subject

In the event that there is overdosage of sodium pentothal, sodium succinate is kept at hand to be given intravenously In my experience this has never been necessary In comparison to other general anesthetics, intravenous sodium pentothal possesses certain advantages for tonsillectomy

1 The ease and simplicity of its administration
2 The complete relaxation obtained even in large and muscular male patients
3 The avoidance of any sense of suffocation by the patient
4 The speed of induction of anesthesia
5 The avoidance of postoperative nausea and vomiting
6 The long period of postoperative somnolence which practically obviates the need for postoperative sedation

There is one great disadvantage in the use of pentothal for tonsillectomy This is bleeding at the time of operation Unquestionably, bleeding is more brisk and profuse than with any other type of anesthesia It has not been my practice to infiltrate the tonsil area with procaine either to supplement the anesthesia, which is unnecessary, or to diminish the bleeding, which leads to a sense of false security It becomes necessary then to control the bleeding promptly and adequately by ligature or suture, or some other means It is important that the throat be completely dry when the surgery is finished, however, this meticulous care to control bleeding at the time of operation has apparently more than repaid the effort, inasmuch as in this series of 183 cases there were no cases of postoperative bleeding

A second disadvantage, or rather a pitfall, which can be avoided, is laryngospasm postoperatively In half a dozen or so of the early cases in the series, laryngospasm occurred after the patient had been transported back to his room in the hospital There was marked cyanosis in each case Invariably, there was some blood or mucus present in the throat and the patient was lying flat on his back Aspiration of the secretions and oxygen was necessary to prevent disaster In later cases, however, careful control of bleeding at operation, elevation of the foot of the bed until the patient regains his reflexes, a rubber airway to prevent swallowing of the tongue, and alertness on the part of the nursing personnel have made this complication almost nonexistent

Conclusion One hundred eighty-three cases of adult tonsillectomies have been reported under intravenous sodium pentothal anesthesia This drug has several advantages over other types of general anesthesia because of ease of administration, speed of induction and freedom from distressing postoperative symptoms Its disadvantage lies in the increased amount of bleeding that occurs at the time of operation For its successful use in tonsillectomies, several cardinal principles must be observed, namely, the head-low position with a visible airway, a well trained anesthetist skilled in its use, supplementary oxygen to prevent hypoxia, careful hemostasis and careful bedside nursing postoperatively In this series of cases there were no ill effects, laryngospasm did not occur at any time during operation, but did occur postoperatively in several cases The convalescence of these patients was not altered and there were no pulmonary complications

THE PROBLEMS OF TONSILLECTOMY AND TRACHEOTOMY IN RELATION TO POLIOMYELITIS*

CONRAD WESSELHOEFT, M D (by invitation),†
Boston, Mass

The problem of tonsillectomy deals with the question of whether or not this operation — which is usually coupled with the removal of the adenoids—constitutes a real danger to the patient in the incubation period or carrier state of poliomyelitis The evidence that there is such a danger was presented in dramatic form in the "K" family of Akron[1,2] There were six children in this family, and five of these were tonsillectomized on the twenty-second day of August By Sept 7 all five of these children had bulbar poliomyelitis, and three of them died The one who was not operated upon showed no sign of illness, but the virus of poliomyelitis was recovered from the stool There were only two scattered cases of polio in Akron prior to this family epidemic, and there were only six additional cases in this city during that September The most probable exposure of this family was four weeks previous to the tonsillectomies during a visit with relatives in a distant community where poliomyelitis was present Other cases have been presented where bulbar poliomyelitis followed closely upon tonsillectomy[3]

The publication of these cases resulted in a ban on tonsillectomies in most hospitals over the country during the season of the year when poliomyelitis is prevalent, namely, the summer months I was one of those who, as a consultant in infec

---

*Read at the meeting of the Eastern Section American Laryngological Rhinological and Otological Society Inc Boston Mass Jan 7 1949

†Clinical Professor of Infectious Diseases Harvard University

Editor s Note This ms received in Laryngoscope Office and accepted for publication April 1 1949

tious diseases, urged this ruling on the grounds that this operation is elective and could be postponed to the colder months when there was less likelihood of there being poliomyelitis virus in the nasopharynx Pedersen[4] and others have given us some interesting food for thought on this matter Last year I revised my opinion on this, recommending that the ideal time for tonsillectomies was immediately after the close of school in June in this part of the country, also that tonsillectomies could continue through the summer months providing there were no cases of poliomyelitis being reported from the community and no known possibility of exposure from outside In Massachusetts last summer the State Board of Health through weekly bulletins kept hospitals informed of the situation of poliomyelitis in this state, as well as over the country at large It would seem that this method offers a satisfactory solution to the tonsillectomy problem, nevertheless, there is always the warning of the "K" family, and regardless of season, you who take the responsibility of performing an elective operation should be aware of the fact that possible exposure at other seasons may occur In this discussion we have come to realize that other dangers besides poliomyelitis confront this operation, and that to be forced to carry it out when upper respiratory infections are most prevalent is a disadvantage to be seriously considered That we were carried too far in our zeal to prevent poliomyelitis through a seasonal ban on tonsillectomies is now clear, but this is just one of many errors that have been made in the numerous efforts in fighting this disease Until we have some quick and practical method of determining the presence of the virus of poliomyelitis in patients on whom tonsillectomy is contemplated, we must rely on epidemiological data as supplied in Massachusetts ship. An ambulance hurrying a case of respiratory failure to a Boston hospital was stopped on the outskirts by a constable who forced the driver to turn back and make a wide detour. One could cite a number of equally drastic and ineffective methods that have been employed. The latest notion is the attempt to control this disease by the destruction of flies through DDT spraying, an experiment which has had no influence on the course of two well studied epidemics. You must understand that our concern regarding tonsillectomies is still very real and logical in view of the accumulated evidence which Dr. Aycock has so ably presented.

On the question of tracheotomy, my opinion remains unshaken. I have had occasion to perform many tracheotomies in the course of 30 years of service on the staff of a contagious disease hospital, and I have had the after-care of many tracheotomies performed by our surgical staff. During these 30 years I have yet to see the case of poliomyelitis that I thought required tracheotomy. This operation has been discussed by the staff on several occasions, both in connection with living cases and at the autopsy table, but never have I been convinced that the indications were present. To my mind, the indications consist of structural obstruction to the airway. In bulbar poliomyelitis I have not been confronted with structural obstruction either from swelling of the parts or spasmodic contractions. The obstruction which occurs is from secretions. The patient cannot swallow, cannot close the glottis, and is, therefore, unable to cough. Postural drainage and gentle, skillful suction are indicated. Atropine, in my experience, does not stop these secretions, it merely dries it into a consistency which makes it more difficult to get rid of. I can imagine a spasm of the vocal cords which could give rise to a crowing inspiration, but I have never encountered this.

At the First International Poliomyelitis Conference in New York last July the subject of tracheotomy was defended by Baker and Priest in the same manner that the subject was presented at the Rocky Mountain Conference in Denver in 1946. In the discussion which followed, there was criticism of the indications given and especially of the readiness to perform the operation early to prevent future obstruction through laryngeal stridor It was pointed out that these authors failed to emphasize the value of postural drainage Wilson, who had been a pioneer in advocating this operation when he was at the Boston Children's Hospital, felt that the operation had been effective in saving the life of a very few patients but he could not accept the indications for this operation as expressed by Priest and Baker In the opinion of Wilson, the chief indication consisted of extreme restlessness due to inability to establish sufficient airway by means of postural drainage and suction Stimson, Shaw, Pierce and Anderson, all with extensive clinical experience in all phases of this disease, expressed a reluctance to endorse the enthusiasm for tracheotomy emanating from the Minneapolis group It is impossible to gauge the value of this operation when performed early, because there is no way of knowing whether it actually saved a life or whether the patient recovered in spite of the added risk of the operation Tracheotomy is a hazardous undertaking Perhaps those of us who have had no experience with tracheotomy in bulbar poliomyelitis are not in a proper position to speak against it It is always possible that the Minneapolis cases presented a peculiar genius epidemicus that warranted this operation, but this is certainly not made clear to most of us who are familiar with the indications and value of tracheotomy in other infections and with the care of the many phases and manifestations of bulbar poliomyelitis

It is appropriate at this time to recall the waves of undue enthusiasm for certain measures which have led us astray in our efforts to deal with poliomyelitis convalescent serum therapy with intrathecal injections, drastic immobilization of the extremities with casts and splints the Kenny concept prostigmine heralded by de Kruif's article in the *Reader's Digest* "They Shall WalkAgain' and Ransohoff's curare and muscle stretching We have been through all of these phases and have had to rearrange and modify our ideas through extensive experience In view of this, it is not surprising that many of us look with misgiving on what today appears to be an over-emphasis of tracheotomy in bulbar poliomyelitis

REFERENCES

1 Krill, C E, and Toomey, J A Multiple Cases of Tonsillectomy and Poliomyelitis *Jour A M A*, 117 1013, 1941

2 Francis, T Jr, Krill, C E, Toomey J A and Mack W N Poliomeylitis Following Tonsillectomy in Five Members of a Family *Jour A M A*, 119 1392 1396, 1942

3 Aycock, W L Tonsillectomy and Poliomyelitis *Medicine*, 21 65 94 1942

4 Pedersen, P M A Statistical Study of Poliomyelitis in Relationship to Tonsillectomy *Ann Otol, Rhinol and Laryngol*, 56 281 293 1947

5 Baker, A B Bulbar Poliomyelitis Rocky Mountain Conference on Infantile Paralysis Denver, Dec 17 17 1946, pp 110 113

CANCER OF THE FACE TREATMENT AND PLASTIC REPAIR *

GORDON B NEW, M D
Rochester, Minn

Patients with cancer of the face do not receive as efficient treatment as one would expect from the site of the lesions and the facility with which a diagnosis can be made When a diagnosis can be definitely established by microscopic examination of either a fresh frozen section or a fixed section it is difficult to understand why so many lesions about the face are treated in a conservative way In cases in which this type of treatment is employed, the growth frequently recurs and becomes fixed to cartilage or bone, or metastasizes to the neck These complications make the necessary treatment much more radical, produce postoperative defects and make the outlook for controlling the growth very questionable Although biopsy should be performed before treatment is instituted in cases in which the diagnosis is questionable, it is much better to remove the entire growth, if possible, and to examine a fresh frozen section to corroborate the clinical diagnosis I do not think that a specimen for biopsy should be removed by a physician who is not prepared to treat the tumor in a radical way if it proves to be malignant The chance for permanent cure will be much better if the surgeon who is to do the operation can examine the patient before a specimen for biopsy is removed so that he is able to determine the apparent extent of the tumor and also to select the site from which the specimen should be removed At times the trauma resulting from

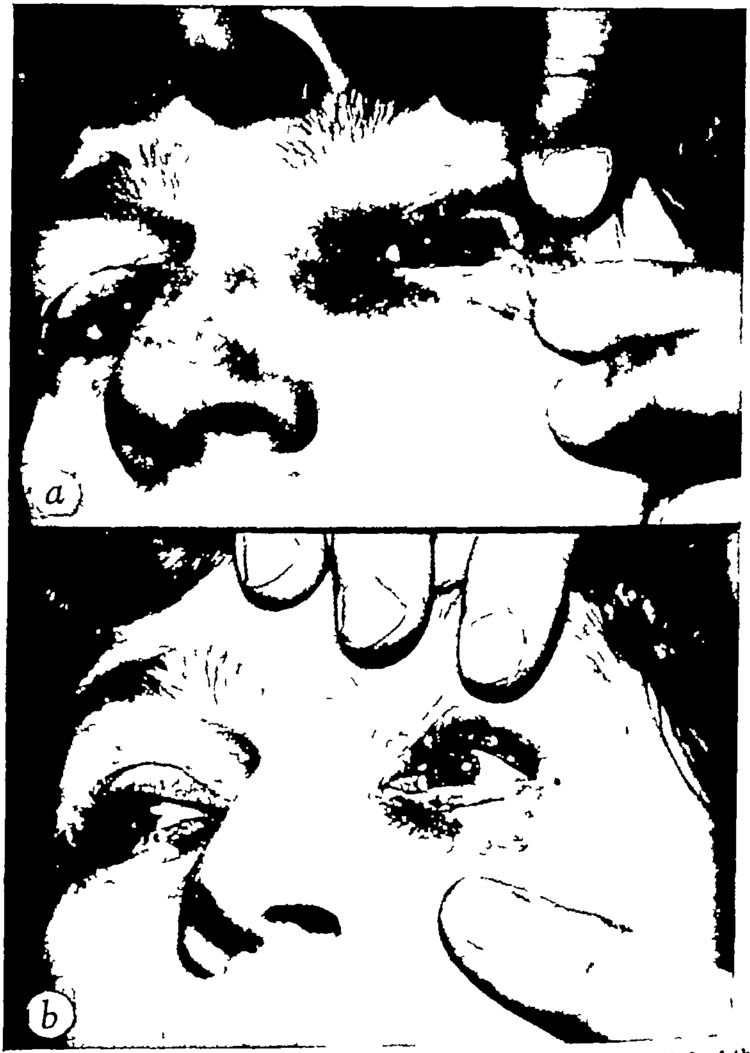


Fig 1 (a) Postirradiated basal-cell epithelioma of the outer third of the upper and lower eyelids and the outer canthus fixed to the orbital conjunctiva The lesion was removed by surgical diathermy (b) Postoperative appearance five months later There was no recurrence after six years

the removal of the specimen makes it impossible to determine how much of the enlargement is the result of the tumor and how much is the result of reaction from the trauma caused by removal of the specimen This makes it difficult for the surgeon to decide how widely to remove the tumor beyond the

a

b

apparent margin Sometimes, in removing the specimen for biopsy, the incision is placed so that it interferes with a pedicle flap or a rotation flap that might be employed in a reparative procedure In other words, if a plastic operation

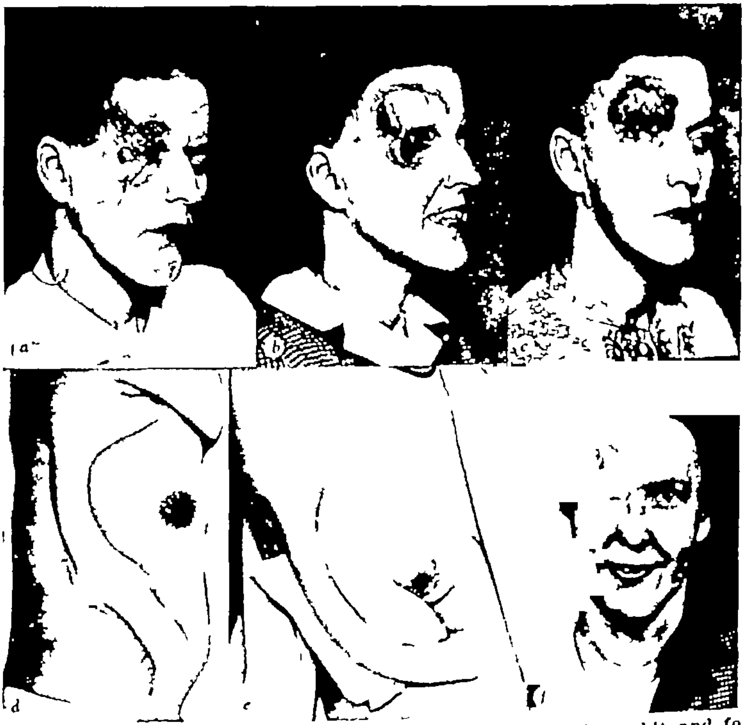


Fig 3 (a) Postirradiated basal-cell epithelioma of the orbit and forehead It was necessary to remove the eye and the growth by surgical diathermy The dura was exposed over an area 2 5 cm in diameter (b) Postoperative sequestrum (c) Wound preliminary to grafting (d) Subaxillary abdominal flap was elevated in two portions (e) The two tube flaps were joined together and brought up in stages to cover the postoperative defect (f) Postoperative appearance two years after removal of the growth

ultimately will be required, the plastic surgeon should be consulted regarding the tumor before its removal, or, better still, he should be allowed to remove the lesion Cancer about the skin of the face may be a basal-cell epithelioma, or both a basal-cell and a squamous-cell carcinoma Although the grade of malignancy of a squamous-cell epithelioma usually is low, it occasionally may be high At times, one sees a squamous cell epithelioma that simulates a sarcoma and grows very rapidly. This type of tumor usually occurs in actinodermatitis which follows irradiation. While the microscopic appearance indicates that this type of tumor is very malignant, I have never seen a case in which the patient did not stay well after wide removal of the tumor with surgical diathermy. This tumor rarely metastasizes. Adenocarcinomas of the mixed tumor type or of the cylindroma type may occur in the parotid region.

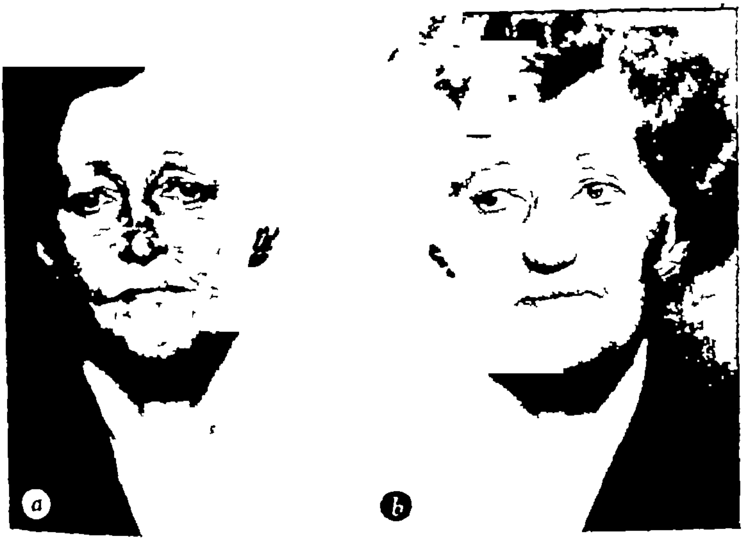


Fig. 4. (a) Actinodermatitis (precancerous) of the nose. The affected tissue was removed and a forehead flap was brought down to replace the defect. (b) Postoperative appearance.

In the surgical management of malignant tumors of the face, either sharp dissection or electrocoagulation (surgical diathermy) may be employed. When using these two methods of treatment, cancer of the face may be divided into four groups: *1* lesions which permit of sharp excision and which after excision, leave wounds that can be closed immediately by simple approximation of their edges, *2* lesions which permit of sharp excision and which after excision, leave wounds that require the use of a skin graft for repair, *3* lesions which should be removed by surgical diathermy and which after electrocoagulation, leave small wounds that heal spontaneously by granulation and epithelialization (see Fig 1), and 4 lesions which should be removed by surgical diathermy and which, after electrocoagulation, leave extensive facial defects that require some form of plastic repair (see Fig 2) Figs 1 through 11 illustrate the treatment and plastic repair of cancer of the face

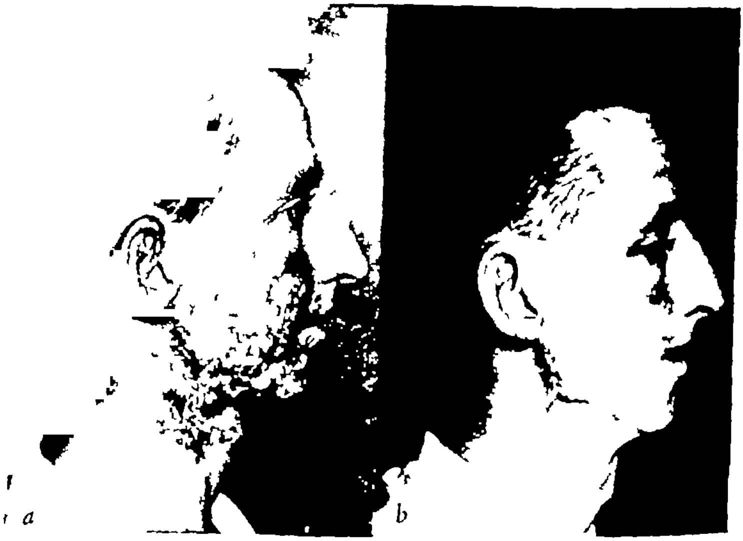


Fig 5 (a) Actinodermatitis (precancerous) of the right cheek and neck The affected tissue was excised and replaced with a full-thickness skin graft (b) Postoperative appearance Partial excision and advancement flaps would reduce the size of the graft.

The first group includes small basal-cell and low-grade squamous-cell epitheliomas of the face which have not been treated previously and which are so situated that primary closure of the wound is possible after wide removal of the growth (see Figs 8 and 9) For instance, many small lesions situated about the forehead, eyelids, lips and cheeks can be treated in this manner Also included in this group of tumors are freely movable adenocarcinomas of mixed tumor type in the parotid region

The second group of tumors includes basal-cell and squamous-cell epitheliomas which are large, which have not been treated previously, and which are superficial and freely movable, after removal, however, the resultant wound is too large to permit appproximation of the skin edges and, consequently, must be covered with a skin graft (see Figs 5 and 6) Either

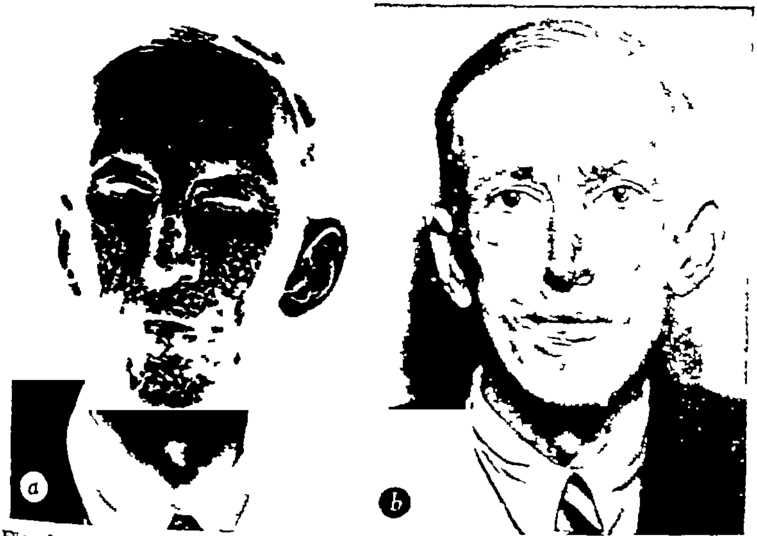


Fig 6 (a) Bilateral actinodermatitis of both cheeks upper lip and chin with multiple areas of epithelioma which were removed and replaced with skin grafts While a delayed or tubed flap might have been employed in this case the character of the skin and the subcutaneous tissue would not permit this (b) Postoperative appearance

a free full-thickness or shaved skin graft is employed for this purpose, usually, I prefer a full-thickness dissected graft If the denuded surface is not too large, a full-thickness skin graft obtained from behind the ear or from the mastoid region is preferable, because its color and textures are very nearly the same as those of the skin of the face In larger areas, a full-thickness skin graft from the supraclavicular region is to be recommended In some instances a more satisfactory repair can be accomplished by means of a small pedicle flap of skin which is advanced over the defect from the adjacent tissues (see Figs 4 and 11)

The third group of tumors includes small malignant lesions which are of a high grade of malignancy or which recur after previous treatment, particularly irradiation therapy

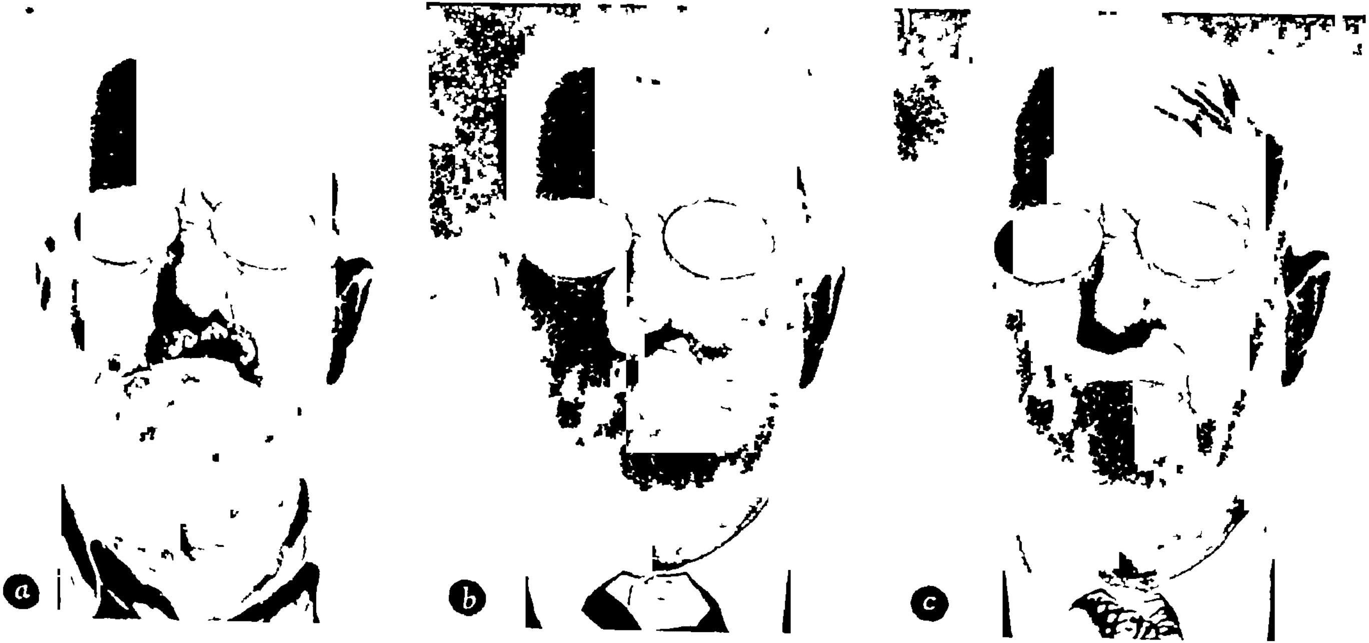


Fig. 7. (a) Postirradiated basal cell epithelioma of the upper lip fixed to the upper jaw and nose. This was removed by surgical diathermy. (b) Appearance 11 months later. (c) One year later a lined sickle flap was employed to reconstruct the upper lip.

The fourth group of tumors includes very extensive malignant lesions of the face which have been treated previously. The most serious members of this group are those skin cancers

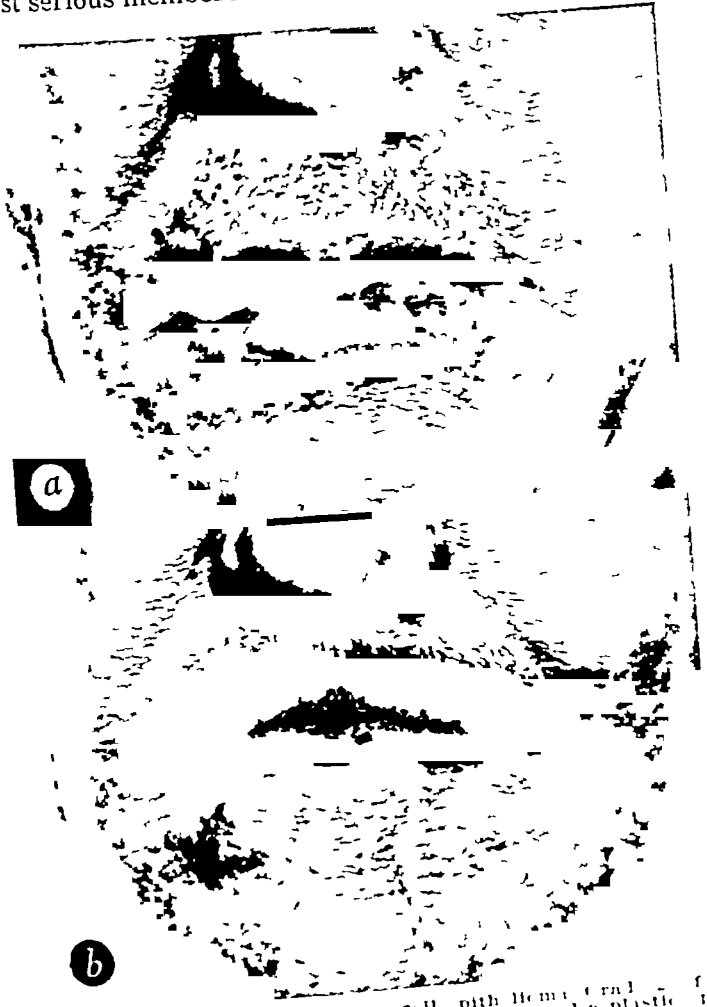


Fig [illegible] (a) [illegible] irradiated squamous cell epithelioma [illegible] of half of the left lower lip (b) The epithelioma was excised and a plastic operation [illegible] at the left angle of the mouth. This was followed by a dissection of the submental and submaxillary glands

which recur after previous irradiation therapy and which are fixed to underlying cartilage or bone about the orbits, jaws, cheeks, ears or nose (see Fig 7). Under these circumstances the patient is well before the defect is repaired If this is done one can be reasonably certain that there will not be recurrence

If the bone of the forehead, skull or malar region has been destroyed, it may be possible to chisel away the sequestrum and allow granulation tissue to come up through the normal

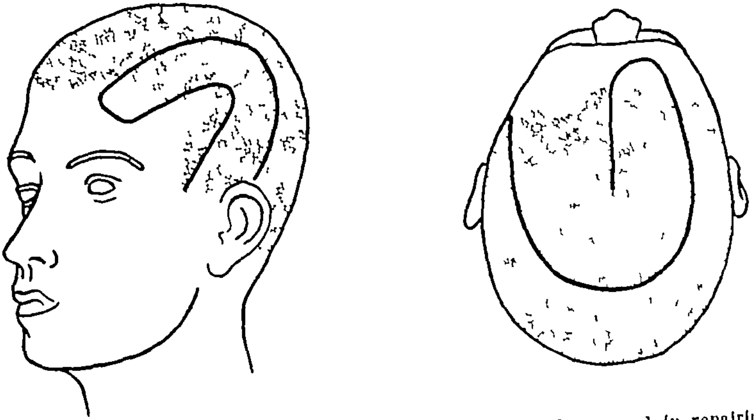


Fig 11 (a) and (b) Lateral and midline sickle flaps used in repairing postoperative defects about the face after removal of carcinoma

bone and then apply a split-skin graft In cases in which the defect is large, various types of pedicle flaps can be employed The common ones for the smaller defects are the lateral and midline sickle flaps For the larger defects, submaxillary, supraclavicular or subaxillary abdominal flaps may be employed (see Fig 3)

Complete primary removal of carcinoma of the face is essential Examination of fresh frozen sections of tissue at the time of the operation aids in determining the best treatment In cases in which the tumor recurs and becomes fixed after irradiation, examination of fresh frozen sections is an aid in determining the limits of the growth Bilateral dissection of the submental and submaxillary glands should be done in cases of squamous-cell epithelioma, Grade 2, 3, or 4, of the lower lip or cheek The time of repair of the postoperative defects should depend on the nature of the growth and on the previous treatment Irradiation, if used at all, should be a secondary procedure

EPISTAXIS *

J H OGURA, M D, and B H SENTURIA M D,
St Louis, Mo

INTRODUCTION

The literature on epistaxis contains many case reports and descriptions of various preferential techniques for handling nasal hemorrhages[1-39] There have been, however, few comprehensive studies which consider the anatomy, histology and pathology of epistaxis as it relates to the clinical problem[40-43]

It is the aim of this study to evaluate the incidence, cause and control of nasal bleeding seen in a large hospital center where both children and adults were observed

ANATOMY

The most frequent bleeding site on the septum is located on the extreme anterior inferior portion of the nasal septum and is known as Little's or Kieselbach's area † The vascular plexus of Little's area is composed of various sized arterioles, capillary and venous channels within the mucous membrane This plexus is supplied by the nasopalatine branch of the sphenopalatine artery, the terminal branches of the descending palatine and superior labial arteries, and the branches of the anterior and posterior ethmoidal arteries (see Fig 1)

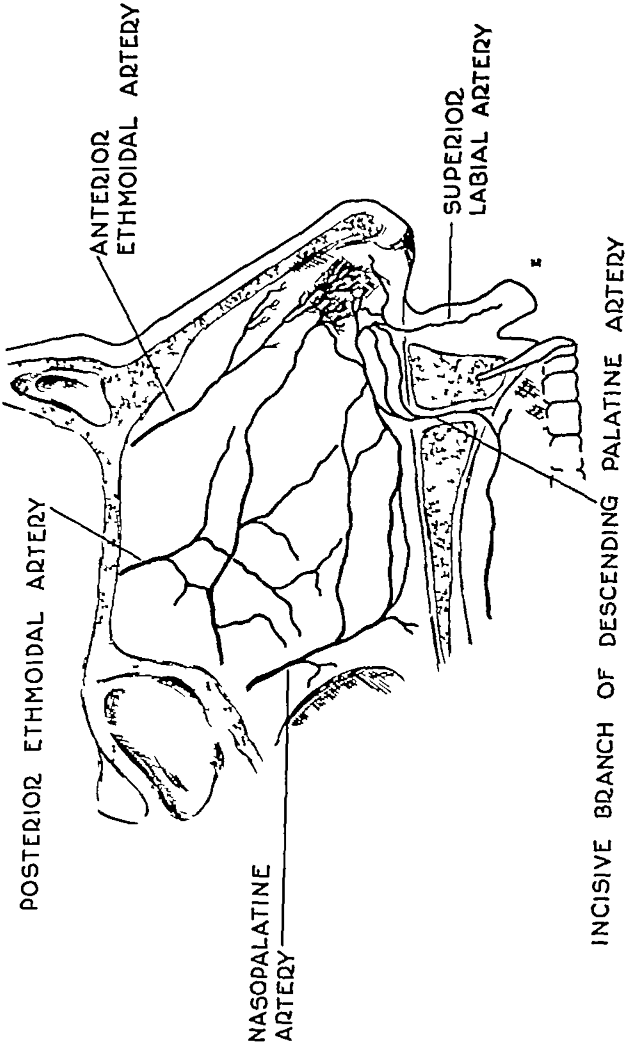
---

*This work was made possible by grant from the Upjohn Co, Kalamazoo, Mich

†Investigation by McKenzie[illegible] revealed that the anatomical description of this area by Little preceded that of Kiesselbach

From the Department of Otolaryngology, Washington University Medical School, St Louis, Mo

Editor's Note This ms received in Laryngoscope Office and accepted for publication March 1, 194[illegible]

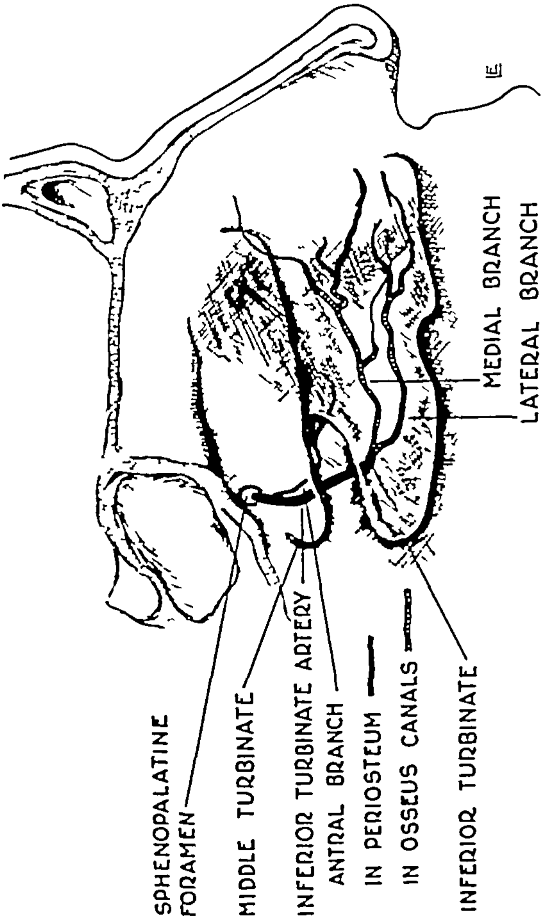

ANTERIOR ETHMOIDAL ARTERY
SUPERIOR LABIAL ARTERY
POSTERIOR ETHMOIDAL ARTERY
INCISIVE BRANCH OF DESCENDING PALATINE ARTERY
NASOPALATINE ARTERY

Nasal Septum Showing Arterial Supply of Little's Area
FIGURE I

Bleeding from the lateral nasal wall has received insufficient attention in the literature, so a review of the vascular supply of the lateral nasal wall is presented in some detail The anterior and posterior ethmoidal arteries supply the anterior and superior parts of the lateral nasal wall, while the branches of the sphenopalatine artery distribute themselves to the posterior and inferior portions

Burnham[40] has investigated and described in great detail the distribution of the branches of the sphenopalatine artery, *viz*, *a*. the inferior turbinate, *b* middle turbinate, and *c* nasopalatine arteries

a The inferior turbinate artery courses downward and forward in the periosteal layer, giving off variable branches to the common meatuses When it reaches the posterior tip of the inferior turbinate, three terminal vessels are given off and pass through bony canals, emerging at the central one-fifth of the inferior turbinate bone These three canals with



LATERAL NASAL WALL SHOWING DISTRIBUTION OF INFERIOR TURBINATE ARTERY AND BRANCHES (MODIFIED FROM BURNHAM)

FIGURE II

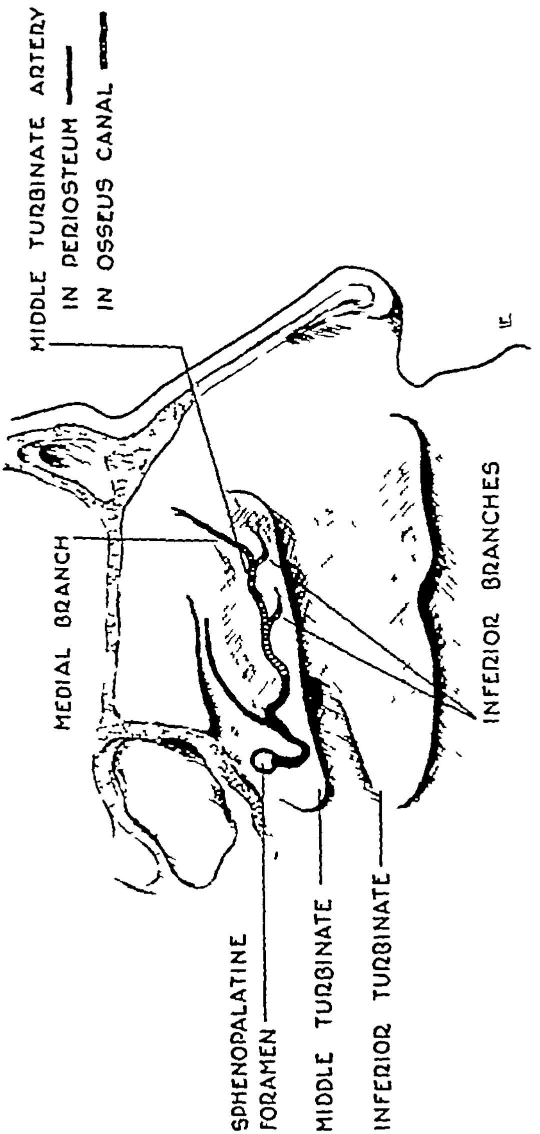
their contained vessels are as follows *1* The canal for the antral vessels passes along the junction of the inferior turbinate with the lateral nasal wall, and is patent along its upper nasal border, *2* The supero-medial canal lies below the antral canal and terminates anteriorly on the medial surface of the inferior turbinate, *3* The infero-lateral canal lies immediately below and emerges on the lateral surfaces of this bone (see Fig 2)

b The middle turbinate artery leaves the sphenopalatine artery and reaches the under surface of the middle turbinate At the junction of the posterior and middle thirds it enters a bony canal and breaks up at the central one-fifth of the middle turbinate to give the following constant terminal branches of this artery *1* a lateral branch to the lateral surface of the turbinate, *2* a medial branch to the medial surface, and *3* an inferior branch which courses along the inferior border of the turbinate (see Fig 3) There is also a fourth variable branch supplying the region of the bulla which may arise near the sphenopalatine foramen

c The nasopalatine artery leaves the sphenopalatine foramen and courses along the attachment of the middle turbinate supplying posterior ethmoidal cells Branches are given off to the anterior inferior face of the sphenoid sinus, to the nasal septum, to the sphenoid ostium, and to the superior turbinate

HISTOLOGY AND PATHOLOGY

At the nasal vestibule there is a transition from the skin of the lip to the nasal mucosa The epithelium of the nasal portion of the vestibule is similar to the skin of the lip Central to this there is a narrow but variable area of nonkeratinized squamous epithelium lacking hair and glands Vascular tufts resembling flat topped papillae which are present towards the external orifice become tall and slender as the nasal mucosa is approached Each of the terminal points of these papillae contain a capillary loop which arises in the highly vascularized corium and comes to lie against a thin basement membrane The basement membranes become pro-



LATERAL NASAL WALL SHOWING DISTRIBUTION OF MIDDLE TURBINATE ARTERY AND BRANCHES (MODIFIED FROM BURNHAM)

FIGURE III

gressively thinner as the capillary comes into close apposition with the epithelium until they can no longer be separated individually. The capillary tuft is accompanied initially by connective tissue fibrils which are lost as the vessel approaches their contained vessels are as follows *1* The canal for the antral vessels passes along the junction of the inferior turbinate with the lateral nasal wall, and is patent along its upper nasal border, *2* The supero-medial canal lies below the antral canal and terminates anteriorly on the medial surface of the inferior turbinate, *3* The infero-lateral canal lies immediately below and emerges on the lateral surfaces of this bone (see Fig 2)

b The middle turbinate artery leaves the sphenopalatine artery and reaches the under surface of the middle turbinate At the junction of the posterior and middle thirds it enters a bony canal and breaks up at the central one-fifth of the middle turbinate to give the following constant terminal branches of this artery *1* a lateral branch to the lateral surface of the turbinate, *2* a medial branch to the medial surface, and *3* an inferior branch which courses along the inferior border of the turbinate (see Fig 3) There is also a fourth variable branch supplying the region of the bulla which may arise near the sphenopalatine foramen

c The nasopalatine artery leaves the sphenopalatine foramen and courses along the attachment of the middle turbinate supplying posterior ethmoidal cells Branches are given off to the anterior inferior face of the sphenoid sinus, to the nasal septum, to the sphenoid ostium, and to the superior turbinate

HISTOLOGY AND PATHOLOGY

At the nasal vestibule there is a transition from the skin of the lip to the nasal mucosa The epithelium of the nasal portion of the vestibule is similar to the skin of the lip Central to this there is a narrow but variable area of nonkeratinized squamous epithelium lacking hair and glands Vascular tufts resembling flat topped papillae which are present towards the external orifice become tall and slender as the nasal mucosa is approached Each of the terminal points of these papillae contain a capillary loop which arises in the highly vascularized corium and comes to lie against a thin basement membrane The basement membranes become pro

The relative absence of inflammation, the poor healing and the presence of deep venous plexus thrombosis led Dohlman to believe that there were important "endogenous factors" in addition to exogenous factors which contribute to the initiation and recurrence of nasal bleeding

CAUSAL FACTORS IN EPISTAXIS

It is beyond the scope of this report to discuss the many factors involved in the etiology of epistaxis, therefore, only the more common diseases with associated epistaxis are listed

A Inflammatory
  1 Acute coryza (vigorous blowing)
  2 Rhinitis sicca
  3 Ozena

B Traumatic
  1 Fracture of nose
  2 Ulceration of septum due to picking
  3 Post-operative
  4 Instrumentation of sinuses
  5 Foreign bodies

C Mechanical
  1 Deviated nasal septum
  2 Nasal polyps

D Disturbances of Circulation
  1 Hypertension
  2 Arteriosclerosis
  3 Nephritis
  4 Telangiectasis

E Blood Dyscrasias
  1 Polycythemia
  2 Leucemia
  3 Purpura hemorrhagica
  4 Hemophilia
  5 Splenic anemia
  6 Anemias

the surface Stratum germinativum is clearly recognizable above the basement membrane, indicating that the capillary loops lie below the deepest layer of the epithelium proper In some cases the epithelium may be so thin that there may be only several cell layers between the capillary loop and the surface of the epithelium [41]

The nasal mucosa which borders this transitional zone is in even closer relationship to the vascular system The epithelium is pseudo-stratified columnar and is composed mainly of mucus producing cells and a few nonciliated columnar cells In the tunica propria, simple and bifurcated capillary loops extend diagonally up to and possibly into the epithelium At the most superficial area the terminal capillary loops lie directly between the columnar cells or beneath the mucus producing cells [41]

Dohlman[42] considered it important to determine whether there was a pathologic explanation for bleeding from Little's area Biopsy specimens were obtained from patients who bled habitually from Little's area and the specimens sectioned serially in order to secure pathologic evidence in epistaxis From these sections a plastocene model was constructed

In one of Dohlman's cases, a biopsy was taken from a patient who had bled three weeks previously and had had no previous local treatment Histological examination revealed a thrombus on the surface of the outer wall of the vessel and over a small part of the endothelium The remaining endothelium was intact There was little if any inflammatory reaction A remarkable absence of healing was present, in view of the fact that the bleeding had occurred three weeks previously In another case of a healthy woman who had bled for several days, serial sections of Little's area revealed a torn blood vessel filled with a thrombus This vessel was in connection with a deep thrombosed venous plexus Round cell infiltration was present around the superficial thrombus In several places, the epithelium which covered the capillaries seemed altered and thus offered poor protection to the capillaries

The relative absence of inflammation, the poor healing and the presence of deep venous plexus thrombosis led Dohlman to believe that there were important "endogenous factors" in addition to exogenous factors which contribute to the initiation and recurrence of nasal bleeding

CAUSAL FACTORS IN EPISTAXIS

It is beyond the scope of this report to discuss the many factors involved in the etiology of epistaxis, therefore, only the more common diseases with associated epistaxis are listed

A Inflammatory
  1 Acute coryza (vigorous blowing)
  2 Rhinitis sicca
  3 Ozena

B Traumatic
  1 Fracture of nose
  2 Ulceration of septum due to picking
  3 Post-operative
  4 Instrumentation of sinuses
  5 Foreign bodies

C Mechanical
  1 Deviated nasal septum
  2 Nasal polyps

D Disturbances of Circulation
  1 Hypertension
  2 Arteriosclerosis
  3 Nephritis
  4 Telangiectasis

E Blood Dyscrasias
  1 Polycythemia
  2 Leucemia
  3 Purpura hemorrhagica
  4 Hemophilia
  5 Splenic anemia
  6 Anemias

F Infectious Diseases
  1 Rheumatic fever and rheumatic heart disease
  2 Scarlet fever
  3 Whooping cough
  4 Smallpox
  5 Diphtheria, nasal
  6 Typhoid and paratyphoid fever

G Granulomata
  1 Tuberculosis
  2 Syphilis (Gumma of nose)
  (Congenital syphilis)
  3 Lupus erythematosus

H Neoplasm
  1 Benign
  2 Malignant

I Vitamin Deficiency
  1 Scurvy
  2 Vitamin K deficiency

J Miscellaneous
  1 Metabolic disease
  2 Liver disease
  3 Vicarious menstruation
  4 Chemical poisoning (Chrome, mercury, phosphorus)
  5 Salicylism
  6 "Endogenous factors"

METHODS PROPOSED FOR THE CONTROL OF NASAL HEMORRHAGE

Because of the disparity of methods used for the control of nasal hemorrhage, only an outline of the techniques will be presented

I Medical

  A Pressure
    1 Pressure pack (cotton or vaseline gauze)
    2 Traction pack (Beavis')
    3 Intranasal balloon (Stevens), (Ford)

B Coagulants
  1 Thrombin (Tidrick, *et al*[4]), (Stevenson), (Fox)
  2 Fibrinogen (Effler[7])
  3 Hemoplastin (Brown[8])
  4 Coagulin (Brown[8])
  5 Claudin (Brown[8])
  6 Vitamin K
  7 Koagumin
  8 Salt pork (Cone[9])
  9 Absorbable sponge
  10 Oxycel (Houser[10])

C Vasospastic Agents
  1 Adrenalin
  2 Posterior pituitary extract (McLaurin[11, 12])
  3 Forced inspiration (Dundas Grant[13])
  4 Ice

D Cautery
  1 Chromic acid
  2 Silver nitrate (Littel[14])
  3 Trichloracetic acid
  4 Electrocoagulation

E Sclerosing Agents
  1 Quinine lactate (Monson)
  2 Sylnasol (Fox)
  3 Ten per cent phenol in almond oil (Asherton)
  4 Five per cent quinine in urethane (O'Kane)

F Iontophoresis (Beck)

G Radium (Scal), (Weiss)

H Unknown
  1 Ovarian hormone (Connell)
  2 Viper venom (Higgins *et al*)
  3 Moccasin venom (Goldman), (Dack)

II Surgical

  1 Submucous resection (Rainey)

B Submucous elevation (Lyman)

C Ligation
  1 Anterior ethmoidal artery (Goodyear[27, 28]), (Windham[29])
  2 Septal branch of superior labial artery (Rosenvold[30])
  3 Internal maxillary (Hirsch[31])
  4 External carotid (Hyde[32]), (McKnight[33]), (Abrahams[34]), (Hawthorne[35]), (Bricker[36]), (Johnson[37]), (Barker[38]), (Spar-Hallberg[39])

HOSPITAL SURVEY OF EPISTAXIS

A survey was made of the hospital records of all cases of epistaxis admitted to Barnes Hospital and Children's Hospital between 1928 and 1942. The study comprised 88 adult cases and 48 children's cases. Only those records were utilized in which complete examinations had been made and accurate data obtained. In all cases a diagnosis of epistaxis, severe enough to require hospitalization, was established with the exception of some of the children's cases where epistaxis occurred incidental to hospitalization for rheumatic fever or rheumatic heart disease. For purposes of analysis, the cases were divided arbitrarily into the following three age groups *1* children's group (under 15 years), *2* young adult group (between the ages of 15 and 40), and *3* an older adult group (between 40 and 80 years).

It will be shown that there are important differences in the three groups with respect to site of bleeding, etiology and type of therapy demanded.

In Chart 1, it is seen that in the two adult groups the incidence of epistaxis among males was higher than among females. It is particularly striking in the older adult group. This is in contrast to the children's group where females were somewhat more affected than males. This may be explained in part by the fact that rheumatic fever and rheumatic heart

TABLE 1 LATERALIZATION OF BLEEDING IN RELATION TO AGE GROUPS

Lateralization	Number of Cases		
	0-15 Yrs	15-40 Yrs	40-80 Yrs
Left Side of Nose	11	21	27
Right Side of Nose	8	12	15
Bilateral	14	6	4
Side Not Stated	15	3	0
Total	48	42	46

TABLE 2 CLINICAL DIAGNOSES ASSOCIATED WITH EPISTAXIS

Clinical Diagnoses	Number of Cases		
	0-15 Yrs	15-40 Yrs	40-80 Yrs
Rheumatic Fever (Active)	16	—	—
Rheumatic Heart Disease (Inactive)	8	—	—
Hypertensive Cardiovascular Disease	—	7	27
Generalized Vascular Sclerosis	—	—	28
Chronic Glomerulonephritis	—	1	—
Leucemia (All Forms)	4	2	1
Aplastic Anemia	—	1	—
Telangiectasis	—	1	—
Purpura Hemorrhagica	1	1	—
Granuloma of Turbinate	—	1	1
Plasma Cell Myeloma	—	—	1
Sphenoethmoid Carcinoma	—	—	1
Syphilis (Congenital or Active)	1	1	—
Infectious Mononucleosis	—	1	—
Maxillary Sinusitis	—	1	1
Dean Needle Irrigation for Diagnosis	—	2	—

In which the Clinical Diagnoses were unrelated to Epistaxis were not included in this table

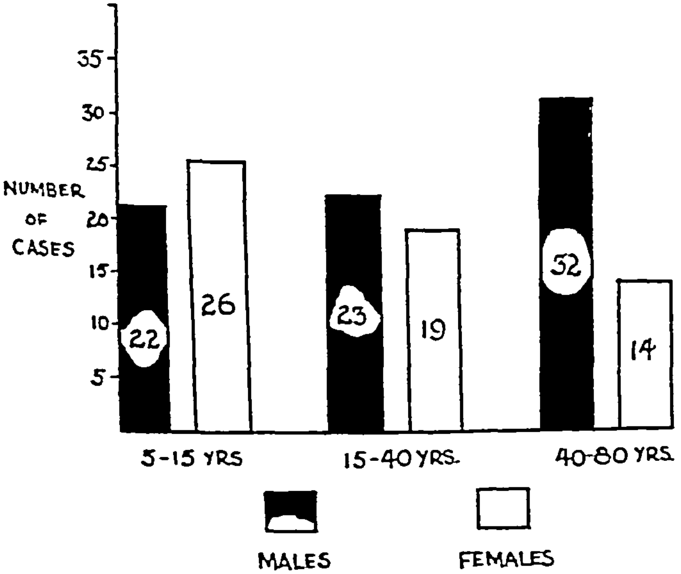
TABLE 3 LOCATION OF BLEEDING IN RELATION TO AGE GROUPS

Bleeding Site	Number of Cases		
	0-15 Yrs	15-40 Yrs	40-80 Yrs
Little's Area	48	30	20
Inferior Meatus, Anterior	—	3	2
Inferior Meatus, Posterior	—	—	6
Inferior Turbinate, Posterior	—	3	1
Middle Meatus, Posterior	—	4	5
Middle Turbinate, Posterior	—	1	1
Superior Meatus, Posterior	—	—	2
Posterior (Exact Site Not Stated)	—	1	10
Posterior Septal Spur	—	—	4
			*

*Multiple Bleeding Points explain discrepancy in totals

CHART I

Sex Distribution of Epistaxis in Relation to Age Groups



disease which are responsible in this study for 50 per cent of the cases of epistaxis in the children's group affects females twice as often as males

Chart 2 shows that in this survey the problem of severe epistaxis in a hospital is most often encountered in individuals between five and 25 years This finding is related no doubt to the high incidence of rheumatic fever in younger individuals The incidence then tapers off and remains uniform in the young adult group There is some increase beyond the age of 50 and a sharp drop past the age of 75 It is interesting to note (see Table 1) that in this study bleeding occurred more often from the left side of the nose in all age groups Although this difference is slight in the children's group the predominance is very marked in the adult group

CHART II

DISTRIBUTION OF EPISTAXIS ACCORDING TO AGE

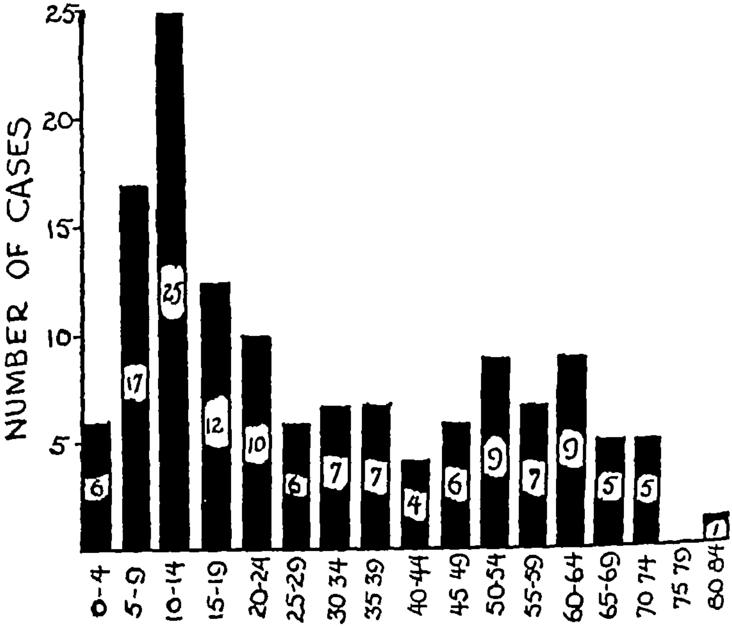


Table 2 represents a summary of all of the clinical diagnoses which were available at the time of this study which might be presumed to bear a causal relationship to severe epistaxis Those cases in which the clinical diagnoses were unrelated to epistaxis were not included in this table

In the children's group, active acute rheumatic fever and inactive rheumatic heart disease represented 50 per cent of the cases (24 out of 48 cases) Recurrent bleeding was twice as common in the active phase as in the inactive state of rheumatic heart disease Leucemia was the causative factor in four cases, congenital syphilis and purpura hemorrhagica each accounted for a single case

Among the cases in the two adult groups, the rheumatic diathesis did not account for a single case of epistaxis In the young adults, hypertension was noted in seven cases, while in the older adults this number was significantly increased (27 cases) As would be expected, generalized vascular sclerosis predominated in the older adult groups (28 cases) In addition a variety of associated clinical diagnoses was noted in both adult groups

In evaluating the site of bleeding (see Table 3), it was considered desirable to classify bleeding as anterior or posterior in origin, as well as the usual designation of lateral and septal, therefore, the nasal fossae were arbitrarily bisected by a vertical plane, drawn approximately between the anterior and posterior tips of the inferior turbinates

In the children's group, all bleeding was anterior and septal Not a single case occurred from the lateral nasal wall or from the posterior half of the nose

In the young adult group, approximately 80 per cent of all bleeding occurred from the anterior part of the nose The remaining cases were posterior in origin from the region of inferior and middle turbinates and the middle meatus

In striking contrast, bleeding in the older adult group is posterior in origin in over half of all cases Twenty-two cases of anterior bleeding and 29 posterior sites of bleeding were observed Anterior bleeding was almost always septal and usually arose from Little's area With the exception of four cases of bleeding which originated from posterior septal spurs, all posterior bleeding developed from the lateral nasal wall The inferior, middle and superior meatuses were the primary sites of this bleeding (13 cases), in 10 instances, the exact site was not stated The inferior and middle turbinates were each involved in one case

TREATMENT

The following were the methods of treatment used

1 Anterior nasal packing (cotton, cotton saturated with adrenalin, vaseline gauze tannic acid and adrenalin and salt pork wedges)

2. Post-nasal packing
3. Cauterization (chromic acid trichloracetic acid, silver nitrate and electrocautery)
4. Submucous elevation and submucous resection
5. Ligation of external carotid
6. Caldwell-Luc operation

Regardless of the type of packing used, anterior nasal packing was usually effective in controlling anterior nasal bleeding. Similarly, cauterization by chemicals or electrocautery effectively sealed off the bleeding vessel when the bleeding point was localized and accessible.

Submucous elevation was performed in nine children. These cases were observed for a varying period of six months to two years. In seven cases bleeding did not return during this period of observation. In the eighth case bleeding was reduced in frequency. In one case there was inadequate follow-up.

Submucous resections were done for intractable septal spur bleeding in one adult under 40 years and one over 40 years with good results for the duration of hospitalization. In one case of bleeding from the maxillary sinus, a Caldwell-Luc was necessary for control of the hemorrhage. Ligation of the external carotid artery effectively controlled posterior bleeding in four instances after all other measures had failed.

In some cases of nasal hemorrhage, adequate control of the bleeding could not be obtained without the use of a post-nasal pack employed in conjunction with anterior packing. Post-nasal packing was not required in any of children's cases, but was necessary in the young adult group in three of the nine cases with posterior bleeding. In the older adult group, however, a combination of post-nasal and anterior packing was required in 16 of the 24 bleeders.

Otitis media is an important possible complication which may result from nasal packing. This occurred in only one case in each age group where anterior packing alone was used (three out of total 103 cases). In contrast, when post nasal packing was used, the incidence of otitis media was higher In the young adult group, two of the nine cases developed otitis media In the older adult group, two of the 16 patients developed otitis media when the posterior packing was allowed to remain in place for five days

DISCUSSION

In evaluating the incidence, causes, location and control of epistaxis, it is essential that cognizance be taken of certain data not included in this study The incidence of bleeding reported here represents a hospital case study and does not necessarily take into account the mild to moderate bleeders treated at home or in the office

Fifty per cent of recurrent epistaxis in the hospitalized children was associated with active or inactive rheumatic heart disease Thus, in rheumatic children, bleeding may be an important otolaryngologic problem The high incidence of epistaxis among children in this study is a result, at least in part, of the large number of rheumatic fever cases observed in St Louis Children's Hospital It is our impression that in private practice there is also a higher incidence of epistaxis in children than in adults It is not to be assumed, therefore that epistaxis occurring in children is pathognomonic of rheumatic fever, however, rheumatic fever should not be overlooked when epistaxis is associated with generalized systemic complaints

In this hospital study we did not find an association of epistaxis and rheumatic heart disease in the young adult or older adult cases This would appear to suggest that nasal bleeding does not occur frequently among adult rheumatics or if it does occur, it is easily controlled by the patient or the physician in charge of the cardiac problem and is therefore not coded and filed as a principal diagnosis

In the older adult group bleeding is frequently associated with hypertension and generalized vascular sclerosis in this series It is shown that well over 50 per cent of those individuals in this age group entering the hospital with nasal bleeding have hypertension * The obvious conclusion follows that in uncomplicated bleeding of older individuals hypertension is to be suspected When bleeding occurs *in this older* group it is posterior in origin in more than half of the cases In contrast, bleeding is invariably anterior in children We are unable to account for this difference unless it is related to hypertensive (and) or degenerative changes in the complex vascular distribution of the posterior lateral nasal wall as described so well by Burnham[40] The larger arteries of the lateral nasal wall are at least in part of their course in a relatively exposed position beneath the mucosa of the common meatuses and the middle and inferior turbinate region It is conceivable that at such points, where the vessels are superficial and weakened by degenerative changes, that severe hemorrhage can easily occur

There is insufficient data in the literature or in this survey to explain satisfactorily spontaneous uncomplicated nasal hemorrhage in otherwise normal children or young adults We do not under estimate the possibility that "endogenous factors" may play a rôle in this group, as suggested by Dohlman[42]

It would appear simpler to consider the following hypotheses, however Overdrying of the nasal mucosa, *e g*, following upper respiratory infection, may cause crusting and scaling of the thin epithelium in Little's area As a result of local trauma associated with vigorous blowing or picking of the nose, the few cell layers of protecting epithelium may be removed, damaging the superficial vascular plexus It can be visualized from the plastocene model by Alverdes and from Dohlman's sections, how irregular and incomplete thrombosis of the capillary loops and venous channels would then result in ineffective control of bleeding and predispose to poor healing and recurrent epistaxis

Post-nasal packing in combination with anterior packing is frequently necessary for control of posterior lateral nasal wall bleeding As a complication, otitis media, hemotympanum, nasopharyngeal abscess and osteomyelitis[39] may occur Since the introduction of chemotherapy, and antibiotics, these complications have been less frequent

---

*The American Heart Association Standards for hypertension were used in our study

The accessibility of the bleeding site determines to a large degree the effectiveness with which hemostasis can be applied Thus anterior bleeding is controlled much more readily than posterior bleeding The type of bleeding usually encountered in children is a capillary or venocapillary ooze which is anterior and septal in position, and, therefore, readily controlled Epistaxis in children is rarely severe enough to cause shock Brisk bleeding is more common in adults and is posterior in origin, hence more difficult to control than anterior bleeding As a consequence it is frequently noted that nasal hemorrhage in the adult group may be so severe and so difficult to control as to produce shock and threaten the life of the patient

It appears that the effectiveness of the anterior nasal pack depends more on mechanical pressure than on the nature of the packing agent Chemical cauterization usually effectively seals the offending vessel when the bleeding point is readily localized and accessible This assumes that the bleeding must have been stopped before the cauterizing agent is applied Electrocauterization was effective in those cases in which brisk bleeding could be visualized but not controlled by simpler means

Submucous elevation is a highly satisfactory procedure for controlling recurrent, anterior septal bleeding in children This procedure was successful in every case where packing or cauterizing agents failed to prevent recurrent bleeding It is a matter of speculation whether the operative intervention in some way alters the vascular supply to Little's area The elevation of the mucosa may change the supporting framework of the vessel and interrupt some of the blood supply to the anterior nasal septum Likewise, intractable bleeding over a septal spur may be effectively controlled by a submucous resection

Ligation of the external carotid artery is a life-saving procedure, and was resorted to as a last measure, in those cases where all other procedures failed to control nasal bleeding

SUMMARY AND CONCLUSIONS

1 A brief review of the anatomy and histopathology of the nose, the causal factors of epistaxis, and the proposed methods for controlling nasal hemorrhage are presented

2 A survey was made of the available records of all cases of epistaxis hospitalized during a 14 year period The cases were divided arbitrarily into three age groups *1* children's group, 48 cases, *2* young adult group, 42 cases, *3* older adult group, 46 cases

3 The incidence of epistaxis was greater among males in the two adult groups Among children, females were affected more often

4 The incidence of epistaxis was greatest between the ages of five and 25 years

5 Epistaxis was present in 50 per cent of children with active rheumatic fever or inactive rheumatic heart disease

6 Approximately 60 per cent of all epistaxis in older adults occurred in patients with hypertension and generalized vascular sclerosis

7 In evaluating the site of bleeding it was considered desirable to classfy its origin as anterior or posterior, as well as septal or lateral

8 Epistaxis in children was always anterior and septal In the young adult group approximately 80 per cent occurred anteriorly, and was predominantly septal Twenty per cent of the cases were posterior and lateral

9 In striking contrast, over half of the older adult nasal bleeding was posterior and lateral in origin Anterior bleeding in this group was almost always septal

10 The usual methods of hemostasis for anterior nasal bleeding, *e g* , anterior nasal packing, electrocoagulation and chemical cautery, controlled single instances of bleeding but did not prevent recurrent episodes Recurrent episodes in children were controlled effectively by submucous elevation

11 A combination of post-nasal and anterior packing was necessary in a higher percentage of posterior bleeding in the older adult group This was required in a smaller number of the young adult group and was not utilized in any of the children

12 Otitis media frequently complicated post-nasal packing This rarely occurred following anterior nasal packing

13 Ligation of the external carotid artery was occasionally a life-saving procedure in the control of epistaxis

---

The authors are indebted to Dr Alexis F Hartmann Physician in-Chief St Louis Children's Hospital for permission to use case records of patients entering St. Louis Children's Hospital and gratefully acknowledge the technical assistance of Miss Betty Levy Miss Elizabeth Ley and Nancy Senturia

BIBLIOGRAPHY

1 Beavis J A Method for Control of Post Nasal Hemorrhage *Ann Otol, Rhinol and Laryngol* 41 576 June 1932

2 Stevens R W Improved Intranasal Packing *Arch Otolaryngol* 23 232 1936

3 Ford W A A Modification of the Stevens Rubber Nasal Balloon Pack *Ann Otol Rhinol and Laryngol* 49 965 1940

4 Tidrick R T Seegers W H and Warner E D Clinical Experience with Thrombin as a Hemostatic Agent *Surg* 14 191 196 Aug 1943

5 Stevenson H N Topical Use of Thrombin *Ann Otol Rhinol and Laryngol* 53 159 1944

6 Fox S L Use of Trombin in Nasal Surgery *Ann Otol Rhinol and Laryngol* 56 127 Mar 1947

7 Hills L R Near Fatal Post Operative Nasal Hemorrhage *Ann Otol Rhinol and Laryngol* 42 201 Mar 1932

8 Brown R B Control of Bleeding in Nose and Throat Surgery *Med Jour Australia* 1 35[illegible] Mar 19[illegible]

9 Cone A J Salt Pork in Cases of Nasal Hemorrhage *Arch Otolaryngol* 32 940 1940

10 Houser K Oxidized Cellulose Gauze Packing for Nasal Bleeding *Jour A M A* 132 14[illegible] 1946

11 McLaurin, J W Use of Solution of Posterior Pituitary of Twice U S P Concentration for Hemorrhage Following Tonsillectomy or Adenoidectomy *Arch Otolaryngol*, 39 536, 1944

12 McLaurin, J W Control of Post Tonsillectomy and Post Adenoidectomy Hemorrhage by Double-Strength Posterior Pituitary Solution The Laryngoscope, 58 1315, Dec, 1948

13 Dundas Grant, J Forcible Nasal Inspiration for Control of Epistaxis *Brit Med Jour*, 1 183, Feb, 1933

14 Littel, J J An Effective Method of Controlling Secondary Hemorrhage The Laryngoscope, 42 207, Mar 1932

15 Monson, L P Treatment of Nasal Hemorrhage with Sclerosing Solutions *Arch Otolaryngol*, 23 398, 1944

16 Fox, S Treatment of Epistaxis by Sclerosing Injections The Laryngoscope, 54 398, 1944

17 Asherton, N Treatment of Epistaxis by Submucous Injections *Jour Laryngol and Otol*, 49 180, 1934

18 O'Kane, G O Hereditary Multiple Telangiectasia *Jour A M A* 111 242, July, 1938

19 Beck, A L Ionization for Control of Severe Hypertensive Epistaxis The Laryngoscope, 49 113 1939

20 Scal, J C Nasal Bleeding Treated with Radium *Arch Otolaryngol*, 15 617, Apr, 1932

21 Weiss, J A Radium Therapy for Recurrent Epistaxis in Hereditary Hemorrhagic Telangiectasia The Laryngoscope, 48 865 1938

22 Connell, E S Ovarian Therapy in Nose and Throat Surgery *Jour Mo Med Assn*, 32 372 Sept, 1935

23 Higgins, L, and Thorne, R Epistaxis Treated with Viper Venom *Brit Med Jour*, 1 640, 1936

24 Goldman, J Moccasin Snake Venom (Ancistrodon Piscivorus) Therapy for Recurrent Epistaxis *Arch Otolaryngol*, 24 59, 1936

25 Dack, S Treatment of Epistaxis with Moccasin Snake Venom *Jour A M A*, 105 412, 1935

26 Rainey, J Nasal Bleeding The Laryngoscope, 41 173 Mar 1931

27 Goodyear, H Etiology and Treatment of Hemorrhage of the Nose and Throat *Jour A M A*, 107 337, Aug, 1936

28 Goodyear, H Ligation of Anterior Ethmoidal Artery The Laryngoscope 47 97, 1947

29 Windham, R E Cause and Treatment of Rhinopharyngeal Hemorrhage *Tex State Jour Med*, 40 484 Jan, 1945

30 Rosenvold, L Intranasal Ligation for Epistaxis *Arch Otolaryngol*, 32 1109, 1940

31 Hirsch, C Ligation of Internal Maxillary Artery in Patients with Nasal Hemorrhage *Arch Otolaryngol*, 24 589 Nov 1936

32 Hyde, F T Ligation of External Carotid Artery for Control of Idiopathic Nasal Hemorrhage The Laryngoscope, 35 899 Dec 1925

33 McKnight, H Carotid Ligation in Epistaxis *Tex State Jour Med* 22 271 Aug 1926

34 Abrahams B H Ligation of External Carotid Artery for Persistent Nasal Hemorrhage *Arch Otolaryngol* 8 29, July 1928

35 Hawthorne A T Ligation of the External Carotid Artery to Control Nasal Hemorrhage *Va Med Month*, 57 370 Sept, 1930

36 Bricker, S Severe Nasal Hemorrhage Due to Infraction of Middle Turbinates The Laryngoscope, 42 735 Aug 1932

37 Johnson, M C, and Foster M E Ligation of the External Carotid Artery for Traumatic Nasal Hemorrhage *Ann Otol, Rhinol and Laryngol.*, 42 588, June, 1933

38 Barker, G N Serious Epistaxis *Jour Laryngol and Otol* 58 293, July 1943

39 Spar, A. A., and Hallberg, O E Severe Epistaxis and Its Management Report of 11 Cases in Which the External Carotid Artery Was Ligated *Ann Otol., Rhinol and Laryngol* 56 141 Mar 1947

40 Burnham, H H An Anatomic Investigation of Blood Vessels of the Lateral Nasal Wall and Their Relation to Turbinates and Sinuses *Jour Laryngol and Otol*, 50 569 Aug 1935

41. Alverdes Kurt The Relationships of Blood Vessels to Epithelium in the Nasal Vestibule *Ztschr f Mikroskop Anatomishoforschung* 22 73 1930

42 Dohlman Gosta The Origin of Nasal Bleeding *Acta Otolaryngol* 26 575 1938

43 McKenzie, D Little's Area or the Locus Kiesselbachii *Jour Laryngol and Otol* 29 21 1914

AMERICAN BOARD OF OTOLARYNGOLOGY

The American Board of Otolaryngology will conduct the following examinations in 1950

Jan 8-11, in New Orleans, La, at the Hotel St Charles

May 17-20, in San Francisco, Calif at Hotel Mark Hopkins

Oct 3-6, in Chicago, Ill at the Palmer House

For further information address Dr Dean M Lierle University Hospital Iowa City Iowa

THE HUMAN EAR AS AN ANALYZER OF SOUND

JOSEPH A SULLIVAN, M B ,* C C GOTLIEB M A , Ph D ,
and W E HODGES, M A Sc ,
Toronto, Canada

INTRODUCTION

The ability of the human ear, under certain conditions, to resolve complex sounds into their component frequencies is well known This paper describes a method whereby this resolution is quantitatively demonstrated The method makes use of a complex tone generator in which the harmonics of the fundamental frequency of the complex tone can be cancelled Subjectively, the ear is able to judge quantitatively when any one of the harmonic components has been eliminated

Any complex tone may be considered as being made up of a set of pure tones which are harmonics of the fundamental frequency of the complex tone and which have amplitudes which are characteristic of the quality of the sound For example, we may consider an earphone vibrating so that it is abruptly excited for a certain time (known as the pulse duration), and then abruptly turned off, the whole process being repeated at a given rate (the pulse recurrence frequency) The mathematical treatment or Fourier analysis shows that the acoustic wave produced by the earphone is equivalent to a fundamental pure tone at the pulse recurrence frequency, plus a set of harmonics of this frequency The amplitudes of the successive harmonics vary periodically at a rate determined

---

*From the Departments of Physics and Otolaryngology University of Toronto Toronto Canada

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 1 1949

by the ratio of the pulse duration to the period of the fundamental Thus, if the pulse is on for one millisecond and off for four milliseconds, mathematical treatment shows that the 5th, 10th, 15th, etc , harmonics are completely absent There is also a regular decrease in the amplitude of the higher harmonics, so that eventually the high frequencies are present in negligibly small proportions

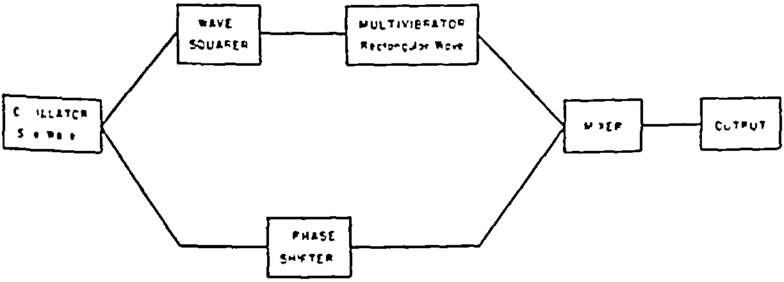


Figure - 1

Block Diagram of Complex Tone Generator

APPARATUS

Fig 1 shows the block diagram of an apparatus for generating in an earphone a recetangular wave form of variable height, duration and recurrence rate The production of pulses of rectangular wave form is accomplished electrically using a multivibrator controlled by an audio frequency oscillator In addition, a mechanism is provided whereby there can be added to the complex tone any one of the harmonics at arbitrary phase and amplitude

Even with the finest quality earphone, the pulse is distorted in the transformation from an electrical to an acoustic wave and with a poor quality earphone the acoustic wave produced bears no resemblance to a rectangular pulse The receiver chosen was a Western Electric Type 711-A The acoustic output could be examined visually by means of a sound pressure meter consisting of a Western Electric Type 640-A condenser microphone, a Sanborn Type 43-145 preamplifier and a cathode ray oscilloscope.* The earphone was coupled to the sound pressure meter by a cylindrical cavity, 6 cc in volume, which is approximately the volume of the external ear canal. At all frequencies above 200 cps and at all pulse widths used, the sound wave form was rectangular. Using the General Radio Wave Analyzer, Type 736-A, an analysis was made of the electrical output of the sound pressure meter for six pulse widths having a recurrence frequency of 200 cps. The wave structure was as calculated for such pulses, and in most cases 40 or more appreciable harmonics were present.†

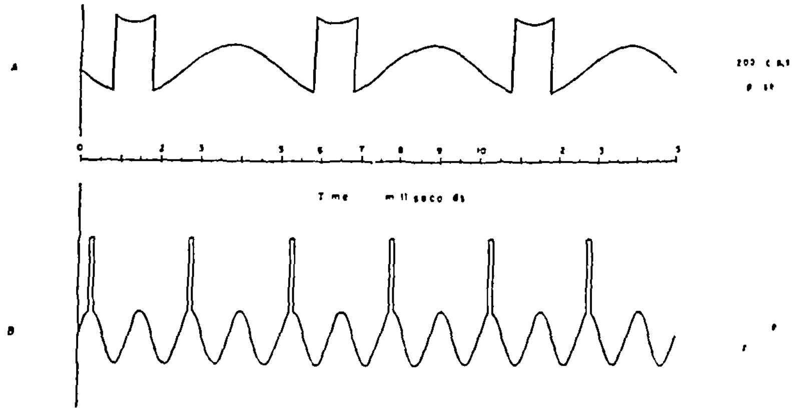


Figure 2

Fig 2a shows a pulse five milliseconds in duration at 200 cps with the fundamental 180° out of phase, and Fig 2b shows a 400 cps pulse of one-fourth millisecond duration, with the second harmonic exactly in phase. The complete harmonic analysis of a typical pulse is given in Table 1. The tests were carried out in one of the quiet rooms of the Department of Physics, University of Toronto.

---

*The response of this system is flat to 5000 cps and is down 3 db at 9000 cps.

†F. E. Terman, Radio Engineers Handbook, p. 22. New York and London: McGraw-Hill Book Co., 1943.

TABLE 1

HARMONIC ANALYSIS OF TYPICAL COMPLEX TONE

No of Harmonic	Frequency	Voltage Generated by Condenser Microphone	No of Harmonic	Frequency	Voltage Generated by Condenser Microphone
	Cycles Per Sec.	Millivolts		Cycles Per Sec.	Millivolts
1	256	100	24	6144	9.4
2	512	100	25	6400	3.8
3	768	78	26	6656	.43
4	1024	37.8	27	6912	2.14
5	1280	5.3	28	7168	2.50
6	1536	16.3	29	7424	2.2
7	1792	28.0	30	7680	1.45
8	2048	28.0	31	7936	.29
9	2304	19.3	32	8192	.72
10	2560	5.7	33	8448	1.47
11	2816	8.0	34	8704	1.94
12	3072	16.4	35	8960	1.46
13	3328	17.8	36	9216	.39
14	3584	12.6	37	9472	.44
15	3840	4.7	38	9728	.54
16	4096	3.9	39	9984	.40
17	4352	7.9	40	10240	.22
18	4608	9.4	41	10496	.10
19	4865	8.2	42	10752	[illegible]
20	5120	4.1	43	11008	[illegible]
21	5376	1.5	44	11264	.08
22	5632	7.8	45	11520	.02
23	5888	13.2	46	11776	[illegible]

WAVE STRUCTURE AND PITCH

On listening to a 100 cps pulse with a pulse duration of one-fourth millisecond the complex tone is found to have a reed-like quality and to possess a definite pitch At first to most observers there is no structure to the tone but on care-microphone, a Sanborn Type 43-145 preamplifier and a cathode ray oscilloscope * The earphone was coupled to the sound pressure meter by a cylindrical cavity, 6 cc in volume, which is approximately the volume of the external ear canal At all frequencies above 200 cps and at all pulse widths used, the sound wave form was rectangular Using the General Radio Wave Analyzer, Type 736-A, an analysis was made of the electrical output of the sound pressure meter for six pulse widths having a recurrence frequency of 200 cps The wave structure was as calculated for such pulses, and in most cases 40 or more appreciable harmonics were present †

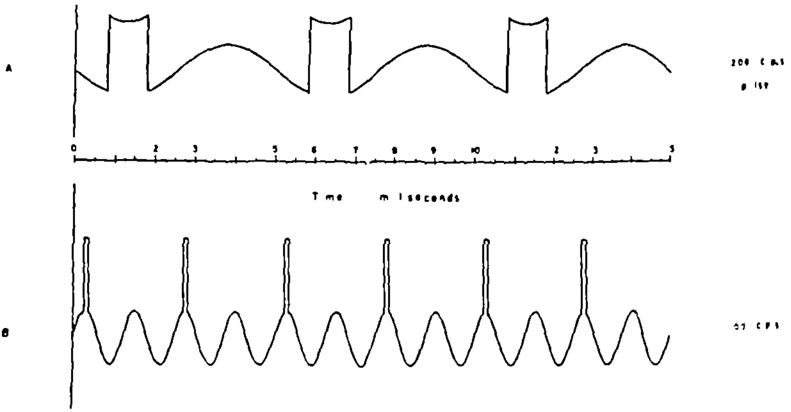


Figure 2

Fig 2a shows a pulse five milliseconds in duration at 200 cps with the fundamental 180° out of phase, and Fig 2b shows a 400 cps pulse of one-fourth millisecond duration, with the second harmonic exactly in phase The complete harmonic analysis of a typical pulse is given in Table 1 The tests were carried out in one of the quiet rooms of the Department of Physics, University of Toronto

---

*The response of this system is flat to 5000 cps and is down 3 db at 9000 cps

†F E Terman Radio Engineers Handbook p 22 New York and London McGraw-Hill Book Co 1943

DYSPHAGIA AND EXTRAESOPHAGEAL PATHOLOGY

A Clinical Review of Some of the Important Surgical Lesions from the Endoscopic Viewpoint.*†

V. K. Hart, M.D.,
Charlotte, N. C.

Dysphagia is always a symptom which should elicit our closest attention and thorough clinical investigation. The cause may be, and frequently is, some intraesophageal pathology, such as carcinoma, stricture, foreign body or some congenital malformation. Benign growths of the esophagus, in our experience, are rare.

These intraesophageal causes of dysphagia are not considered in this presentation. Postcricoid carcinoma and tumors of the hypopharynx are also purposely excluded. Likewise, neuromuscular lesions, such as bulbar palsy and myasthenia gravis, together with hysterical and functional dysphagia, are disregarded. I thought it would be more interesting and instructive if we considered some of the extraesophageal lesions that may give rise to dysphagia and with respect to which there have been important surgical advances in recent years, particularly since some of the causes may be overlooked if both esophagoscopy and Roentgen studies are not done. Furthermore, some of these conditions may be difficult to differentiate clinically. I refer especially to diaphragmatic herniation, cardiospasm and malignancy of the cardia. The latter two may be confused even by the expert Roentgenologist.

---

*Read at the meeting of the Southern Section, American Laryngological, Rhinological and Otological Society, Inc., Washington, D. C., Jan. [illegible]

†From the Charlotte Eye, Ear, Nose and Throat Hospital and Department of Otolaryngology of the Charlotte Memorial Hospital.

‡Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Feb. [illegible], 1949.

ence to the oscilloscope) until it is subjectively judged that no fundamental is present The amplitude of the fundamental actually present is then measured acoustically by the sound pressure meter and the wave analyzer If increasing the pure tone decreases the indication on the wave analyzer, the judgment was considered to be made with insufficient canceling fundamental and such indications are called negative The indications are considered positive when increasing the pure tone increases the indication on the wave analyzer Remainders, due mostly to an inexact adjustment of the phase controls, are not given a sine Since the pure tone vanishes only at the correct position of both controls, the minimum is very sharp for a proper setting If one of the controls is in error, the minimum produced by the other does not go to zero, so that the sharpness of the final minimum is the best indication that the balance has been made Measurements for the higher harmonics are made in the same way Table 2 shows the readings for a typical set of observations

CONCLUSION

These readings show that the ear is able to judge exactly when a given harmonic is absent from a complex tone In this way the ability of the ear to perform a quantitative structural analysis of a complex sound is illustrated

DYSPHAGIA AND EXTRAESOPHAGEAL PATHOLOGY

A Clinical Review of Some of the Important Surgical Lesions from the Endoscopic Viewpoint *†

V. K. HART, M.D.,
Charlotte, N. C.

Dysphagia is always a symptom which should elicit our closest attention and thorough clinical investigation. The cause may be, and frequently is, some intraesophageal pathology, such as carcinoma, stricture, foreign body or some congenital malformation. Benign growths of the esophagus, in our experience, are rare.

These intraesophageal causes of dysphagia are not considered in this presentation. Postcricoid carcinoma and tumors of the hypopharynx are also purposely excluded. Likewise, neuromuscular lesions, such as bulbar palsy and myasthenia gravis, together with hysterical and functional dysphagia, are disregarded. I thought it would be more interesting and instructive if we considered some of the extraesophageal lesions that may give rise to dysphagia and with respect to which there have been important surgical advances in recent years, particularly since some of the causes may be overlooked if both esophagoscopy and Roentgen studies are not done. Furthermore, some of these conditions may be difficult to differentiate clinically. I refer especially to diaphragmatic herniation, cardiospasm and malignancy of the cardia. The latter two may be confused even by the expert Roentgenologist.

---

*Read at the meeting of the Southern Section, American Laryngological, Rhinological and Otological Society, Inc., Washington, D. C., Jan. [illegible]

†From the Charlotte Eye, Ear, Nose and Throat Hospital and Department of Laryngology of the Charlotte Memorial Hospital.

[illegible] This ms. received in Laryngoscope Office and [illegible] Jan. [illegible] 194[illegible]

Last, the symptoms may be quite confusing at times, indeed, diaphragmatic hernia and cardiospasm may simulate coronary and gall bladder disease as pointed out by Vinson,[1] Trueman, Herman and Singer,[3] and Clark [4]

Pharyngoesophageal Diverticulum It is logical to begin the discussion anatomically with the pharyngoesophageal diverticulum This phrase is not accurate in describing what is really a herniation of the mucosa and submucosa of the hypopharynx between the inferior constrictor of the pharynx and cricopharyngeus [5 6] Such herniations are commonly on the left but may occur on the right or posteriorly in the midline Harrington[6] states that in some instances the less common median types may manifest themselves below the lower level of the cricopharyngeus This is a pulsion mechanism in contradistinction to the traction type of true esophageal diverticulum found occasionally at the level of the crossing of the left bronchus

Fig 1 Case 1 Large diverticulum of the pharyngoesophageal type The barium-filled sac is plainly shown in this anteroposterior view

Case 1 Pharyngoesophageal diverticulum The record of this 54 year old male is briefly epitomized He was first seen on June 21 1916 The chief complaint was difficulty in eating and drinking *His symptoms had begun two years previously* He first noticed that food seemed to stop in the upper food passage The dysphagia had slowly gotten worse with a 54 pound weight loss At times he found it necessary to leave the table and regurgitate food. On assuming the recumbent position he had a full feeling related to the upper sternum and which was worse if he turned on his side

The only findings of clinical significance in his physical and laboratory examinations were those found by X ray and esophagoscopy The former showed a large diverticulum typically located in relationship to the upper esophagus It measured about 5 cm in diameter

Esophagoscopy revealed a large blind sac near the cricopharyngeus At that time I was not able to definitely identify the opening of the cricopharyngeus Later, by means of a black silk thread previously swallowed we were able to identify the opening and enter the esophagus which showed no pathology Residual food of course was found in the diverticulum By means of the thread a feeding tube was placed in the stomach This allowed us to build up his nutrition A single-stage operation with the help of Dr Paul Sanger was done under local anesthesia on Aug 1 1946 The patient made an uneventful convalescence and has remained symptom free since

Comment There is no more grateful patient than one relieved of this so-called diverticulum With the advent of chemotherapy, the single-stage operation, as advocated by Harrington,[6] has come into more general use In a patient with some contraindication due to other co-existing pathology the two-stage operation as done by Lahey[illegible] will probably continue to be useful At times he has merely suspended the sac and left it

In a very large diverticulum, the cricopharyngeal opening may be so displaced by the weight of the diverticulum that the patient cannot even swallow a thread One of our patients presented such a problem We had to introduce a shot to which the thread was attached, under direct endoscopic vision Even then we could not thread a feeding tube into position but had to introduce the tube with the thread as a guide under direct vision with the aid of bronchoscopic forceps

I feel more secure with a feeding tube in position prior to operation and left there for the immediate postoperative period This seems a safer procedure for men of limited experience with this condition such as myself Harrington does not introduce a tube unless a cervical fistula develops

As with any obstructive esophageal situation the frequency of chest complications must be kept in mind The danger of aspiration of food and saliva is ever present

Such symptoms may even be misleading We recently had a patient with a pharyngoesophageal diverticulum, but we also fund a co-existing and advanced carcinoma of the left bronchus The importance of complete study is thus emphasized

Superior Mediastinitis Proceeding downward, anatomically, it is now appropriate to present a case of superior mediastinitis The clinical history and course were most interesting and are, therefore, abstracted in some detail

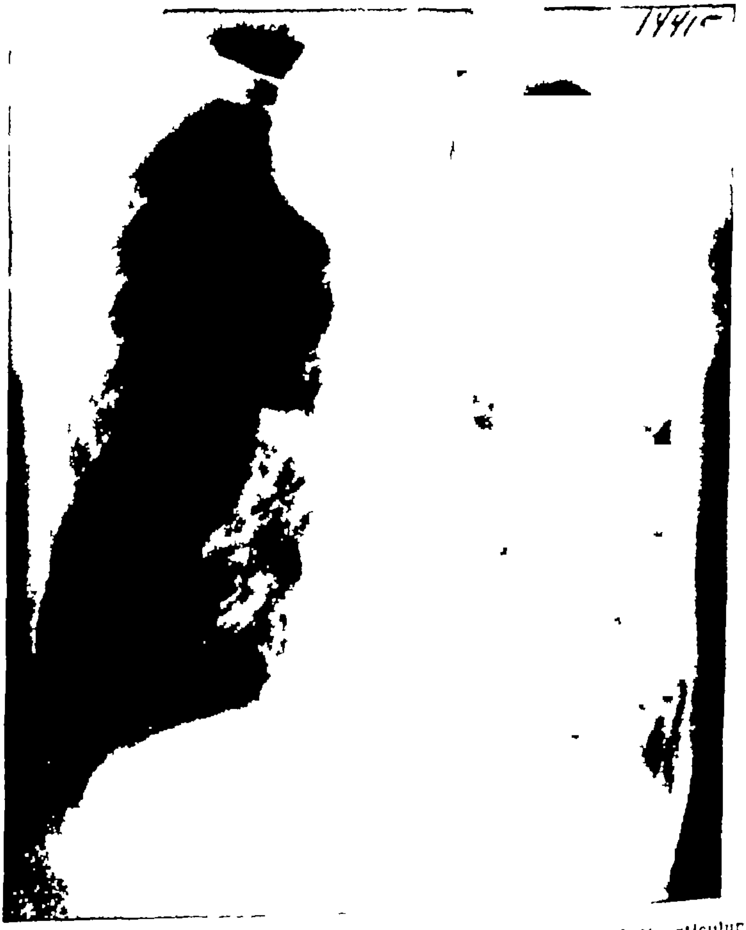


Fig 2 The X-ray film of another large pharyngoesophageal diverticulum is reproduced A fluid level of barium is clearly seen in the sac itself

Case 2 Superior mediastinitis This patient was a white married female 33 years of age She presented herself on Aug 15 1941 complaining of a painful throat. She had been well until 10 days previously At that time while eating an overdone homemade biscuit a piece lodged in her throat She went to the hospital in her home community where local manipulation was done She stated the piece of biscuit then went into the esophagus where it lodged Since then she had been able to swallow liquids only and had had some fever for the preceding three days

Examination showed a bilateral infiltration of the neck from the upper level of the thyroid cartilages to the lower neck She swallowed with great difficulty followed by strangling Indirect laryncoscopy showed edema of the hypopharynx and arytenoids The cords seemed to move poorly A lateral X ray film revealed marked swelling of the soft tissues anterior to the cervical spine and in the center of the swelling a pocket of either gas or air

An esophagoscopy was attempted the same day under local anesthesia The patient developed immediate dyspnea I did not attempt to complete the esophagoscopy but proceeded immediately with a tracheotomy under local anesthesia This was completed without difficulty

All feeding by mouth was stopped Glucose and saline were given intravenously The following day she was given 300 cc of whole blood by the indirect method At the time of her transfusion her blood count was R B C 4 760 000 W B C 41 500 and hemoglobin 11 5 gm or 74 5 per cent Urinalysis was normal

On Aug 16 1941 endoscopy was done under local anesthesia The hypopharynx was first exposed with a Jackson laryngoscope A fluctuating mass just above the right arytenoid was noted This was incised with a laryngeal knife alligator forceps inserted and foul pus evacuated by suction A No 5 esophagoscope was then gently inserted into the esophagus and the upper portion explored There was marked edema of the mucosa, but no foreign body was seen

Two days later this patient became stuporous cyanotic and the temperature rose to 105 6° (r) These symptoms were thought to indicate a superior mediastinitis and an immediate drainage of the superior mediastinum by way of the neck approach was done Light ether anesthesia supplemented by local novocaine infiltration was used Foul smelling pus was encountered about the upper esophagus and the dissection carried downward into the upper mediastinum Drains were placed and the wound closed

She developed marked respiratory depression immediately afterwards requiring oxygen artificial respiration and stimulants Five hundred cc of blood had been started by vein as the operation was begun Following this 1000 cc of 5 per cent glucose and saline were given intravenously She regained consciousness a few hours later At this time a Levine feeding tube was passed through the nose into the stomach

She was given another transfusion the following day She steadily improved and she was extubated and discharged from the hospital on Aug 28 1941 She still had some slight discharge from the neck wound but this healed uneventfully within two weeks

Comment I feel that her infection was probably caused by trauma from the biscuit and that it probably began as a retropharyngeal abscess Her subsequent course, after drainage of the hypopharynx, can be explained only by a descending infection into the mediastinum The patient's recovery, with drainage of this area, leave little doubt as to the mediastinitis

In our experience, other extraesophageal lesions producing dysphagia between the cricopharyngeus and the diaphragmatic hiatus are quite uncommon Some of the causes we have encountered in this area have been metastatic glands from carcinoma of the breast and marked curvature of the spine Vinson[7] also mentions tumors of the thyroid, acute thyroiditis and aneurysm Mosher[8] recorded cervical exostoses as a cause of dysphagia

Hiatal Hernia The next important extraesophageal lesion as we go downward, and possibly one of the most frequently overlooked, is the hiatal hernia The first case found at operation at the Mayo Clinic, according to Harrington,[9] was in 1908, and the first diagnosis by X-ray at the same clinic was in 1921

It might be well to review briefly the types of diaphragmatic hernia Harrington[10] divided them into traumatic and nontraumatic The nontraumatic may be congenital or acquired If congenital (still quoting Harrington), the sites in probable order of frequency are *a* through the hiatus pleuroperitonalis (foramen of Bochdalek), *b* through the dome, *c* through the esophageal hiatus, *d* through the foramen of Morgagni, *e* through the gap left by the absence of the left diaphragm

Embryologically, Dorsey[11] states the most common type of diaphragmatic hernia is through the foramen of Bolchdalek He reports two infants in whom surgical repair was successfully done and states that the child with such may die at birth from asphyxia or aspiration pneumonia Surprisingly, he places hiatal hernia as the 'second most common type, because McNealy[12] and his confreres report that it constitutes more than two-thirds of all nontraumatic diaphragmatic hernias

Harrington's[9] figures show that practically all of his patients operated upon for hiatal hernias were of the paraesophageal type He describes two subgroups *1* The lower esophagus is not above the diaphragm *2* The lower esophagus is above the level of the diaphragm He believes that a true congenitally short esophagus is rare, because he found only five cases at operation in his large series, four of which could be corrected with the stomach below the diaphragm

I was rather surprised at this low incidence of congenitally short esophagus I found in our files from 1941 to date, 17 cases in which a diagnosis of diaphragmatic herniation had been made Two cases were diagnosed by X-ray only, but the X-ray reports did not clearly differentiate between the short esophagus and the paraesophageal type Fourteen other cases done by myself were all diagnosed as herniations at esophagoscopy My diagnosis was confirmed by subsequent X-ray studies in nine of the 14 patients, but again the X-ray reports were indefinite as to whether the patient had a paraesophageal type or a congenitally short esophagus By reviewing what films I could find, three were found showing a congenitally short esophagus

Roentgen studies did not confirm the esophagoscopic diagnosis in three patients Two other such patients had no follow-up X-ray studies

One patient clearly showed the herniation on the X-ray film together with a stricture above Esophagoscopy, however demonstrated only the stricture as the 'scope could not be gotten safely beyond the obstruction even after endoscopic dilatation however, whether part of the stomach is through the hiatus because of a congenitally short esophagus or because of some congenital deficiency in the hiatus or because of injury, is largely academic to us as endoscopists The important thing is the diagnosis

In that connection, by far the most common complaint was difficulty in swallowing A few complained of burning beneath the sternum and one, of pain Frequently there was a history of periodic difficulty in swallowing, with or without vomiting, extending back over a period of years Only one of our patients had had bleeding[13]

Several times I have had patients come in completely obstructed with a bolus of food Diaphragmatic herniation was not suspected until we found the food mass in the herniation This was also reported by Clerf and Manges[14] I should like to recapitulate briefly such a case and two other typical cases without food impaction

Fig 3 Case 2 Lateral X-ray view of neck showing marked bulging of the soft tissues anterior to the cervical spine There is also a significant pocket of gas or air showing in the swelling itself This patient later developed a mediastinitis of the superior mediastinum

Case 3 Hiatal hernia with superimposed food impaction This woman 86 years of age was first seen by a gastroenterologist on Dec 13 19[illegible] because of inability to swallow This had come on suddenly 48 hour previously while eating The patient was studied with barium a diagnosis of foreign body made and the patient was referred to me for esophagoscopy This was done under local anesthesia using an [illegible] Jackson esophagoscope At 33 cm from the upper gum margin a large impacted food mass was found Following its removal it was found that the scope met firm resistance at 36 cm with no evidence of intra esophageal tumor There was no stricture and I thought I could see stomach mucosa beyond The esophagoscopy was discontinued and the patient sent back to the referring physician with a diagnosis of diaphragmatic herniation with secondary impaction of food

This diagnosis was confirmed by subsequent X ray studies moreover questioning of the family brought out a history of periodic esophageal obstruction for years Several times something had been dislodged with a stomach tube by a physician of her home community

[illegible] oblique view of diaphragmatic herniation The striations of the barium coated stomach rugae are clearly seen above the level of the [illegible] The esophagus and the esophagogastric junction show poorly The [illegible] of the esophagus have therefore [illegible] with greater clarity The roentgenologist thought this was [illegible] with a congenitally short esophagus

In that connection, by far the most common complaint was difficulty in swallowing A few complained of burning beneath the sternum and one, of pain Frequently there was a history of periodic difficulty in swallowing, with or without vomiting, extending back over a period of years Only one of our patients had had bleeding[13]

Several times I have had patients come in completely obstructed with a bolus of food Diaphragmatic herniation was not suspected until we found the food mass in the herniation This was also reported by Clerf and Manges[14] I should like to recapitulate briefly such a case and two other typical cases without food impaction

Fig 3 Case 2 Lateral X-ray view of neck showing marked bulging of the soft tissues anterior to the cervical spine There is also a significant pocket of gas or air showing in the swelling itself This patient later developed a mediastinitis of the superior mediastinum

Case 3 Hiatal hernia with superimposed food impaction This woman 86 years of age was first seen by a gastroenterologist on Dec 13 1945 because of inability to swallow This had come on suddenly 48 hours previously while eating The patient was studied with barium a diagnosis of foreign body made and the patient was referred to me for esophagoscopy This was done under local anesthesia using an 8 x 45 Jackson esophagoscope At 33 cm from the upper gum margin a large impacted food mass was found Following its removal it was found that the scope met firm resistance at 36 cm with no evidence of intra esophageal tumor There was no stricture and I thought I could see stomach mucosa beyond The esophagoscopy was discontinued and the patient sent back to the referring physician with a diagnosis of diaphragmatic herniation with secondary impaction of food

This diagnosis was confirmed by subsequent X ray studies moreover questioning of the family brought out a history of periodic esophageal obstruction for years Several times something had been dislodged with a stomach tube by a physician of her home community

[illegible] oblique [illegible]
[illegible] barium coated stomach mass [illegible]
[illegible]
[illegible]
[illegible] for greater clarity [illegible]
[illegible] with [illegible]

Case 4 Hiatal herniation with congenitally short esophagus This patient, 62 years of age, was referred by his family physician on Jan 20 1944, for an esophagoscopy His chief complaint was difficulty in swallowing *He had had periodic* trouble for *two years* but denied *trouble* in earlier life There was no history of ingestion of a caustic Esophagoscopy was done under local anesthesia An 8 x 45 Jackson esophagoscope was passed The esophagus showed no pathology but stomach mucosa was encountered at 37 cm from the upper gum margin The 'scope could not be forced into the stomach without undue trauma There was a small, brownish, yellow mass within the folds of the cardia and apparently attached to the left wall *It did* not impress me as malignant but small specimens were removed with punch forceps (Microscopic examination later showed these to be food) The esopha

Fig 5 Case 5 This anteroposterior view reveals a large diaphragmatic herniation The greater redundancy of the esophagus in this case is indicative of the paraesophageal type

goscopy was then discontinued and a diagnosis made of hiatal hernia probably with a congenitally short esophagus This diagnosis was sustained by later Roentgen studies

Case 5 Paraesophageal hiatal hernia A white male aged 60 years was admitted to the hospital on May 29 1945 with the complaint of of inability to swallow He stated that he had been unable to retain anything for three days There had been periodic difficulty in swallowing for 15 years It was apt to come on suddenly while eating He would then vomit and have no further trouble until the next attack The symptoms this time had lasted longer than with any previous attack

Esophagoscopy was done under local anesthesia An 8 x 45 Jackson esophagoscope was passed Just beyond 35 cm from the upper teeth, what was apparently stomach mucosa was encountered I was not able to get the scope below a level of 37 cm without unsafe force and I could not get a bougie into the stomach with reasonable manipulation The esophagoscopy was then discontinued A diagnosis of diaphragmatic herniation was made with probably a congenitally short esophagus X ray study showed the hiatal herniation of a paraesophageal type The patient was able to swallow following the instrumentation Four months later he returned with a complaint of not being able to swallow even water His obstructive symptoms had been going on for two days An esophagoscopy again verified the herniation at about 36 cm from the upper incisor teeth A moderate sized dilator was passed The following morning he was able to swallow quite well

Comment I am not always sure, as illustrated by the last case, whether the herniation, as seen through the esophagoscope, is associated with a short esophagus or one of normal length Theoretically, it should be relatively easy by accurate measurements to make the differential diagnosis, nevertheless, I cannot always make the distinction Harrington[9] states that the abdominal esophagus is only 0 5 to 1 5 cm long, therefore, any redundancy could easily be taken up by pressure of the 'scope on the contralateral wall The best differentiation is by X-ray

Most of my patients have done very well on a dietary regime of small meals at frequent intervals rather than large feedings I have been very conservative in dilating these cases It would seem unwise unless they have obstructive symptoms, and even then they should be done with great prudence Some outstanding men, such as Vinson,[7] use dilatation in selected cases The death of only one patient with a herniation has nevertheless made me quite conservative, particularly since she died of a mediastinitis following uncomplicated esophagoscopy without any dilatation Older patients with an esophagitis of long standing should especially inspire caution

The most dramatic results have come from surgery Either the abdominal or the transthoracic approach may be used Both have their advocates Detailed discussion of this aspect is not pertinent

The ulcer of the esophagus near the esophagogastric junction, which occasionally occurs, should be mentioned This may be from the pressure of the hernia itself or the irritating effects of the gastric contents [9] This in turn may give rise to stricture with obstructive symptoms Such symptoms may also be due to a concomitant cardiospasm Two of Harrington's[10] patients continued to have cardiospasm after operation

A second case of herniation with stricture above the cardia (one other case previously mentioned) was observed This required dilatation through the esophagoscope Later he was dilated by a dilator on a swallowed thread, but got quite a reaction with fever He promptly recovered with hospital management and chemotherapy Since then I've been quite willing to let well enough alone, as long as the patient has no marked obstructive symptoms

Finally, hiatal hernia and cardiospasm may occur secondary to the sclerosis of acrosclerosis and scleroderma The herniation occurs as a result of secondary shortening of the esophagus, and the achalasia possibly because of changes in the esophageal wall which could interfere with the nerve supply These facts are brought out in a very excellent paper by Olsen[15] and his associates I have never seen such a case

Cardiospasm and Carcinoma of the Cardia As we end our journey down the esophagus, it is appropriate to consider these two extraesophageal lesions together I say this because it is not always easy in the early stages to differentiate by either X-ray or esophagoscopy the early tumor of the cardia and cardiospasm I am sure that all endoscopists agree that every case with a tentative X-ray diagnosis of achalasia should be esophagoscoped before any dilatation is done

Not only is tumor of the cardia confused with cardiospasm but at times even with hiatal hernia The following cases illustrate some of the problems encountered

Fig 6 Both an esophageal stricture (A) and a diaphragmatic herniation (B) are shown in this photograph Such a stricture is probably the end-result of esophageal ulceration secondary to the herniation

Case 6 Carcinoma of the Cardia Suggesting Esophagoscopically Hiatal Hernia and Cardiospasm by X ray The patient was 69 years of age and first seen on Oct 29 1944 Her chief complaint was difficulty in swallowing Her present trouble had begun three months previously when she began to regurgitate food This became worse until at the time of admission she could swallow and retain very little food She had lost 40 pounds in weight Her daughters stated that for a good many years she had had one or two attacks a year of pain and indigestion followed by vomiting which would relieve her symptoms A recent X ray study had shown obstruction at the cardia and the question arose as to whether this was cardiospasm

Esophagoscopy was done under local anesthesia using an 8 x 45 Jackson esophagoscope Some retained secretion and liquid were aspirated

The esophagus was normal until what was thought to be stomach mucosa was encountered between 36 and 37 cm from the upper gum margin Resistance was firm and no dilator could be safely passed No abnormal tissue was seen I thought she probably had a congenitally short esophagus with a hiatal hernia and the esophagoscopy was discontinued

X ray studies were done by a very excellent roentgenologist and failed to reveal any herniation or definite evidence of tumor A diagnosis of probable cardiospasm with esophagitis was reported It was subsequently found that a Mosher air bag could not be introduced into the stomach

The esophagoscopy was then repeated At 35 cm from the upper gum margin, there was encountered what was either edematous esophageal

Fig 7 Case 1 The obstruction of the lower esophagus shown here was diagnosed radiographically as cardiospasm Esophagoscopically there was some suggestion of diaphragmatic herniation An advanced carcinoma of the cardia was demonstrated surgically

mucous membrane due to an intramural or periesophageal mass or stomach mucosa I got the definite endoscopic impression that there was a mass below the obstruction in the periesophageal tissues

The patient was losing ground and vomiting almost constantly She was therefore referred for surgical exploration This was done nine days after admission and an extensive carcinoma of the stomach found which had already ruptured but had been walled off by the omentum It was obvious that there was nothing that could be done surgically

Case 7 Carcinoma of the Cardia Suggesting Roentgenographically Cardiospasm. This white male age 63 years was referred for esophagoscopy on April 13 1943 He complained of inability to eat and had had progressive symptoms for several months The roentgenologist reported a cardiac obstruction suggesting cardiospasm

Fig 8 Case 8 Esophagoscopy in this patient revealed what was thought to be cardiospasm. A later gastroscopic examination on the insistence of the radiologist revealed probable carcinoma of the cardia which was sustained by the histopathologic report of the biopsy

Esophagoscopy was done under local anesthesia An 8 x 50 Jackson esophagoscope was passed At the cardia encountered at a normal distance, was found a small, bleeding, indurated mass, attached to the left wall Biopsy was done and the esophagoscopy discontinued The pathologic report was adenocarcinoma

Case 8 Carcinoma of the Cardia Almost Missed by Improper Visualization This 53 year-old male was referred to me by an internist for esophagoscopy He had had dysphagia and the X ray findings showed an obstruction at the cardia suggestive of tumor I did an esophagoscopy using an 8 x 45 Jackson 'scope, with negative findings More X ray studies were done and reported as showing a lesion in the upper stomach The esophagoscopy was repeated under local anesthesia on March 10 1948 This time I used an 8 x 50 'scope and a lesion on the right lateral wall of the stomach at 46 cm from the upper gum margin was easily visualized and biopsied The pathologic report was adenocarcinoma

An extensive resection was done with an esophagogastrostomy by the consulting chest surgeon, nevertheless, he died of extensive abdominal metastases six months later

Comment The endoscopist should be very suspicious of a malignancy at the cardia if one or more of the following conditions are encountered First, firm resistance to the introduction of the esophagoscope into the stomach Especially if pain is registered by the patient This obstructive phenomenon is quite different from that of cardiospasm as emphasized by Allison[16]

Second, one should be wary of tumor if a dilating bag cannot be safely introduced into the stomach on a previously swallowed thread Even if the bag can be introduced, further suspicion should be aroused if a poorly yielding wide band of resistance is noted fluoroscopically, rather than the usual constricting ring seen at the cardia in cardiospasm There may be even abnormal resistance to the withdrawal of the bag in a malignancy of the cardia Such cases, though biopsy has not been feasible, or, if done, negative, should suggest surgical exploration Carcinoma of the cardia will often be found

Last, the failure of a supposed cardiospasm without any angulation of the esophagus to respond satisfactorily to dilatation bespeaks re-examination of the patient for an unrecognized malignancy I have just had such a patient Using a 50 cm esophagoscope in the second esophagoscopy, an adenocarcinoma of the cardia was readily visualized and proven by biopsy, although the man was only in his early thirties, moreover, the failure to use the longer instrument caused me to miss the lesion on the first examination in one other case (Case 8)

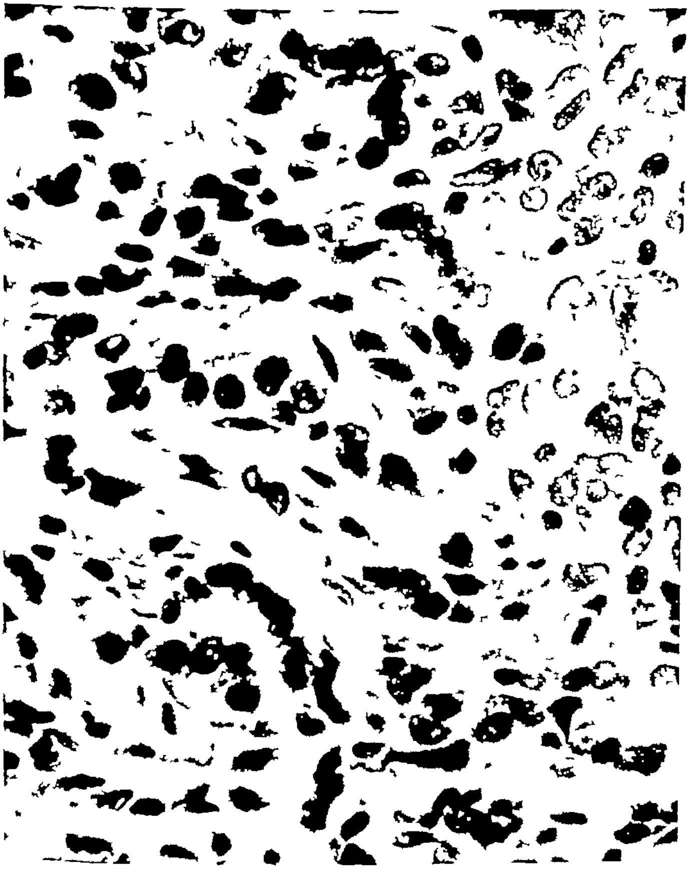


Fig 9 Case 8 High power magnification showing infiltration with strands of pleomorphic but mostly cuboidal epithelial cells the adenomatous character of which is only suggestive. The cells however do not bear resemblance to squamous elements Pathologic diagnosis (Dr Paul Kimmelstiel) adenocarcinoma.

Vinson[1] makes an important point in the differential diagnosis of cardiospasm He states it is the only disease which produces definite angulation and dilatation

This so-called sigmoid type of cardiospasm, which often responds poorly to dilatation, is now being treated successfully by both transabdominal and transthoracic surgery[17-19]. Likewise, new hope is now being offered by thoracic surgery to patients with carcinoma of the cardia and esophagus[20-24] It is not within the scope of this paper to review this literature, but it is our function as endoscopists to know that this help is now available for these patients

Summary The more important extraesophageal lesions causing dysphagia have been discussed with the citation of illustrative cases They were presented in the order of their anatomical sequence, *viz*, pharyngoesophageal diverticulum, superior mediastinitis, hiatal hernia and carcinoma of the cardia Cardiospasm was included only from the standpoint of surgical treatment and differential diagnosis Emphasis was placed on the endoscopic aspects which concerned diagnosis and management It is felt that hiatal hernia and carcinoma of the cardia are probably more frequent than usually realized Attention was called to the recent surgical advances in their treatment

BIBLIOGRAPHY

1 VINSON PORTER P The Diagnosis and Treatment of Cardiospasm *South Med Jour*, 40 387, May, 1947

2 TRUEMAN K R Diagnosis and Treatment of Paraesophageal Hiatus Hernia *Canad Med Assn Jour*, 56 149, Feb 1947

3 HERMAN, MYRON and SINGER EMANUEL Paraesophageal Hiatal Hernia A Case Manifesting Gastrointestinal and Cardiac Symptoms and Presenting Itself on X ray as a Mediastinal Tumor *N Y State Jour Med* 46 1020 May, 1946

4 CLARK WILLIAM EARL Gastrointestinal Conditions Simulating or Aggravating Cardiovascular Disease *Jour A M A* 128 356 June 2 1945

5 LAHEY, FRANK H Esophageal Diverticula *Arch Surg* 41 1118 Nov 1940

6 HARRINGTON STUART W Pulsion Diverticulum at the Pharyngoesophageal Junction Surgical Treatment in 140 Cases *Surg* 18 66 July 1945

7 VINSON PORTER P Diagnosis and Treatment of Diseases of the Esophagus Springfield, Ill, and Baltimore Md Charles C Thomas pp 200 201

8 MOSHER HARRIS P Exostoses of the Cervical Vertebrae as a Caus for Difficulty in Swallowing THE LARYNGOSCOPE 36 181 Mar 1926

9 Harrington Stuart W Esophageal Hiatus Diaphragmatic Hernia *Jour Thoracic Surg*, 8 127, Dec 1938

10 Harrington Stuart W Diaphragmatic Hernia *Jour A M A* 101 987, Sept 23 1933

11 Dorsey John M The Surgical Repair in Various Types of Diaphragmatic Hernia Surgical Clinics of North America W B Saunders Co Feb 1946 p 152

12 McNealy Raymond W and McCallister John W Transabdominal Repair of Esophageal Hiatus Hernia Surgical Clinics of North America W B Saunders Co Feb 1947 p 109

13 Elkeles A Paraesophageal Hernia as a Cause of Recurrent Gastrointestinal Hemorrhage *Proc Roy Acad Med* 39 305 Nov 9 1945

14 Clerf Louis H and Manges Willis F Congenital Anomalies of the Esophagus with Special Reference to the Congenitally Short Esophagus with a Portion of the Stomach Above the Diaphragm *Ann Otol Rhinol and Laryngol* 42 1058 Dec 1933

15 Olsen Arthur M, O Leary Paul A and Kirklin B R Esophageal Lesions Associated with Acrosclerosis and Scleroderma *Arch Int Med.*, 76 189 Oct 1945

16 Allison, P R Carcinoma of Lower Esophagus and Cardia *Proc Roy Acad Med* 39 415 Feb 6 1946

17 Clagett O Theron Moersch Herman J and Fischer Albert Esophagogastrostomy in the Treatment of Cardiospasm *Surg Gynec and Obst* 81 440 Oct 1948

18 Grimson K S Reeves R J Trent J C and Wilson A D The Treatment of Patients with Achlasia by Esophagogastrostomy *Surg* 20 94 July 1946

19 Bell, H Glenn Treatment of Cardiospasm by Esophagostrostomy *Surg* 20 104 July 1946

20 Clagett O Theron Transthoracic Resection of the Cardia and Esophagus *Tex State Med Jour* 42 7 May 1946

21 DeBakey Michael E and Ochsner Alton Esophagectomy and Esophagogastrostomy for High Intrathoracic Esophageal Lesions *Selected Writings of the Ochsner Clinic* 7 47 June 30 1948

22 Churchill, E D and Sweet R H Transthoracic Resection of Tumors of the Stomach and Esophagus *Ann Surg* 115 897 June 1942

23 Garloch J H Combined Abdominothoracic Approach for Carcinoma of Cardia and Lower Esophagus *Surg Gynec and Obst* 83 737 Dec, 1946

24 Sweet R H Transthoracic Resection of Esophagus and Stomach for Carcinoma Analysis of the Postoperative Complications Causes of Death and Late Results of Operation *Ann Surg* 121 272 Mar 1945

CONTINUOUS PHARYNGEAL SUCTION DURING TONSILLECTOMY UNDER LOCAL ANESTHESIA*

LORENZ W RUDDY, M D ,
Sacramento, Calif

INTRODUCTION

When a tonsillectomy is performed under local anesthesia, particularly when the patient is in a sitting or semirecumbent position, several things may or do happen which are undesirable The patient may become faint and require at least a temporary placement in a recumbent position Saliva, pus and blood may be aspirated into the tracheobronchial tree, with the danger of an ensuing pulmonary infection[1,2] The aspirated material may also choke and alarm the patient, while the accompanying cough scatters blood annoyingly about Even when this does not occur, the accumulation of blood may obscure the operative field and interrupt the operation until the blood can be expectorated

In an effort to overcome these objectionable features, it has been found that by placing the patient in a certain dorsal recumbent position and by combining this with a method of continuous pharyngeal suction, a satisfactory answer to the problem is obtained This procedure will be described and is the object of this presentation

In the development of this procedure continuous suction and the recumbent position were employed from the beginning These methods appeared most likely to lead to success and each depended upon the other At first, various modifications

---

*Read at the meeting of the Western Section American Laryngological Rhinological and Otological Society Los Angeles Calif Jan 30 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 7 1949

of the commonly used Yankauer tonsil suction tube were employed, either alone or combined with a metal tongue depressor Similar suction tubes have been devised by Moore,[3] Myerson,[4] Hunt[5] and others for use primarily in tonsillectomy under general anesthesia These suction tubes must be held by an assistant, and very often they become displaced from the position where suction is needed They also tend to get in the way of the surgeon at times Though their use is more satisfactory than operating without suction and though they have been used for several years, an improved technique was desirable

A real advance was made in 1945 with the employment of a catheter with multiple perforations near its tip This was inserted through an anesthetized nasal passage into the oropharynx Its use was a decided improvement over the oral suction tubes previously employed Various sizes of catheters and perforations were used until the most satisfactory combination was found A further refinement in the method resulted when two such catheters were used, because occasionally one tube tends to become partially obstructed by blood clots

TECHNIQUE

A Preparation of the Patient

Preparation of the patient actually begins when tonsillectomy is advised Local anesthesia is suggested as the choice of anesthetic if the patient is not too nervous or does not possess an excessive gag reflex Quicker recovery under this form of anesthesia is pointed out to the patient Other advantages are the relaxing effect of adequate sedation and of the recumbent position, and freedom from gagging, choking or expectoration by using suction "which removes saliva and any blood that may run into the throat"

While in surgery the patient is continually assured by proper "vocal" anesthesia and is impressed with the importance of regular breathing and of the avoidance of swallowing

Preoperative Medication Adequate sedation and analgesia are both most important While the preoperative medication for each patient is individualized, the average adult patient receives nembutal* grs iii orally, one and one-half hours before surgery, then morphine sulphate grs ¼ with atropine sulphate grs 1/150 *hypodermically, one hour* before surgery Morphine relaxes the stomach and increases the tone of the pylorus thereby delaying passage of stomach contents For this reason nembutal, when given orally, is administered in advance of morphine to insure adequate absorption of the barbiturate in the small intestine If sedation is not sufficient when the patient reaches the operating room, additional medication should be given intravenously This is seldom necessary, however Scopolamine is preferred to atropine for some patients because it enhances the degree *of hypnosis* The smaller doses are used, otherwise *proper cooperation of* the patient may not be preserved

Recumbent Position The operating table top is put in the horizontal plane Then a moderately firm bed pillow is placed under the patient's back and shoulders, but not under the neck This arrangement permits moderate extension of the head and neck so that the posterior pharyngeal wall slopes downward from the larynx to the nasopharynx (see Fig 1)

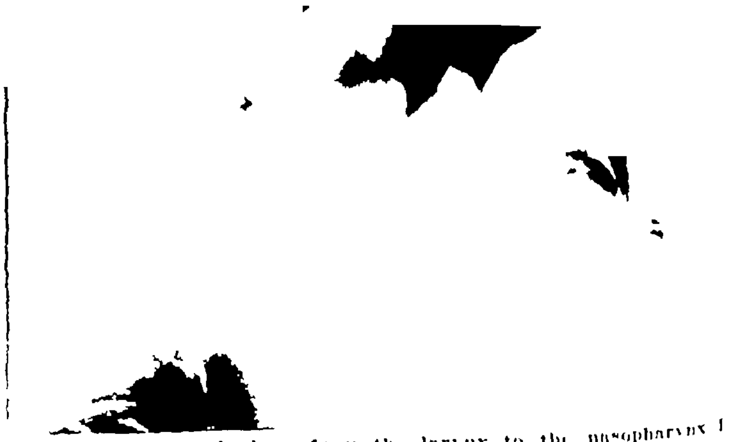


Fig 1 The downward slope from the larynx to the nasopharynx is shown in this head extended position

---

*Sodium pentobarbital

This position reduces the chances of aspirating blood The head extended position is not so protective as the Trendelenberg or Rose positions as shown by Hara[6] in cases of general anesthesia, but, nevertheless, it is quite effective, furthermore, under local anesthesia, the patient is much more comfortable in the head-extended position than in one of the Trendelenberg positions

A review of the literature on this subject reveals that Bettington also advocated the head-extended recumbent position in performing tonsillectomy under local anesthesia No mention of suction was made, but possibly it was employed in some form

Topical Anesthesia (by spray) About 10 minutes before surgery the patient's nose and throat are sprayed with a solution comprised of three parts of 2 per cent pontocaine* and one part of 1 per cent neosynephrine † If the patient says "ah" as this is being done, the spray is less liable to enter the larynx, and the tongue drops to the floor of the mouth, permitting the spray to strike the posterior pharyngeal tissues This spraying is repeated five minutes before surgery

Draping A sterile body drape, which is split at the neck, is applied The patient is instructed to raise his head while the tails of the drape are barely overlapped under the head, and next a large sterile towel is placed where the head will be when it is lowered The ends of the towel are then folded across the forehead and firmly fixed with a towel clip The head towel should be tight enough not to slip, as the suction tubes are to be fixed to it later

Topical Anesthesia (with cotton applicator) A metal cotton applicator is used to swab the nose and pharynx with the pontocaine-neosynephrine solution The applicator is passed through the middle meatus and nasopharynx into the oropharynx and there swabbed from side to side It is drawn out through the inferior meatus of the nose This procedure is repeated through each nasal passage a few times until anesthesia is complete (see Fig 2)

---

*Tetracaine hydrochloride U S P
†Phenylephrine hydrochloride

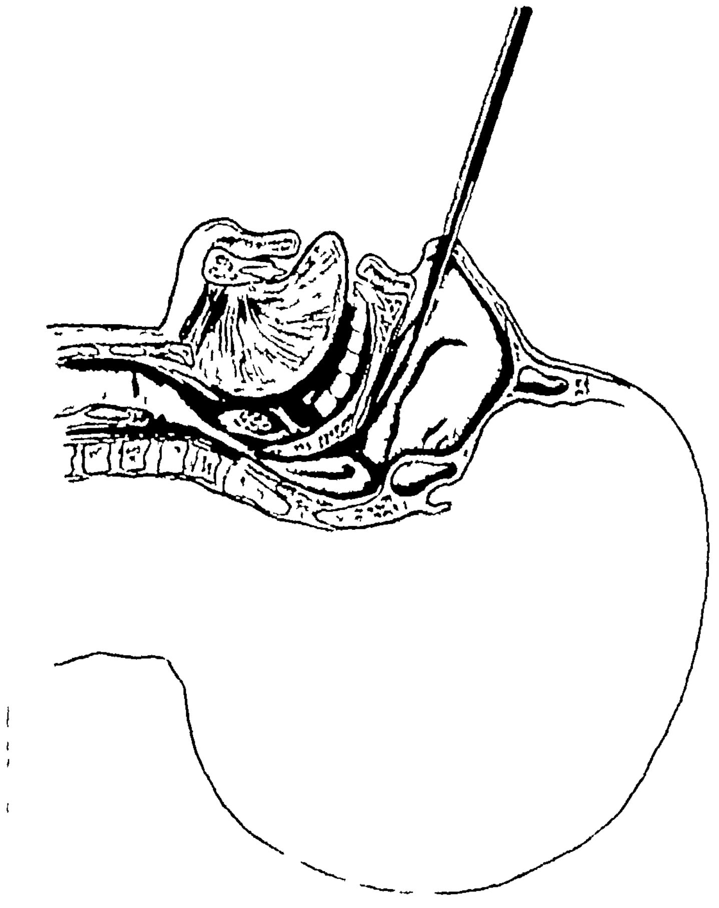


Fig 2 The metal cotton applicator used to swab the nose and pharynx is about seven inches long with the distal three inches curved in a 90 degree arc

The lips are anointed with vaseline, and then with an applicator similar to that used in the nose, the mouth and pharynx are swabbed with the same local anesthetic The areas covered are the tongue, down to its base, the hard and soft palate, the tonsils and their pillars, and the posterior pharyngeal wall down towards the larynx Applications are repeated until the gag reflex has completely disappeared Unless this precautionary technique is followed, the suction tubes or surgical procedure will cause gagging and the method will fail

Suction Quarter-inch suction tubing is fixed by a towel clip to the top of the table just to the left of the patient's head The tubing is fitted with a pressure regulating clamp and a quarter-inch glass "Y" tube

The suction tubes* consist of two 14F male red rubber catheters which have multiple perforations in their tips (see Fig 3)

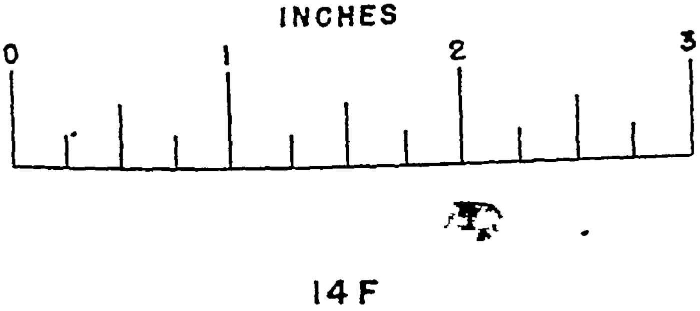


Fig 3 Tip of a nasal suction tube

The tip of one of the suction tubes is dipped in vegetable jelly and inserted through the nose into the nasopharynx This process is repeated with the other tube The nasopharynx is entered most easily by following the curved path offered by the middle meati, however, if there is an obstruction in the nose, other pathways must be used (see Fig 4)

---

*The tubes can be easily made or they may be obtained from the Clay-Adams Co 141 East 25th Street, New York 10 N Y Single eye catheters are selected. Those of natural red rubber seem to hold their shape better than those of synthetic rubber The tip is grooved around its circumference just back of the rounded portion with a five-eighths inch double cut Joe Dandy dental separating disc using a straight dental handpiece and machine The portion just back of this is thinned for about one-eighth inch with the same equipment so that a mushroom-like cork results This is severed from the tip and then the eye of the catheter is cut away Rubber cement is applied to the inside of the end of the catheter and to the neck of the cork, and the two are cemented together The rounded tip prevents trauma to the tissues as the catheters are introduced into the nose and pharynx. An opening in the end of the tip is undesirable as it may catch the tip of the epiglottis during suction.

Four openings in the catheter are made in line one-quarter inch apart, starting just proximal to the end of the rubber cork. A No 702 crosscut tapered fissured dental burr (straight hand piece) is used to make these openings They are carried through to the other side to make eight such openings The burr is passed back and forth to ream out the openings until they are about one-sixteenth inch in diameter Then at right angles to these holes two sets of holes are made at the same interval but staggered between the two sets of four holes resulting in a total of 14 perforations in the tip portion of a suction tube

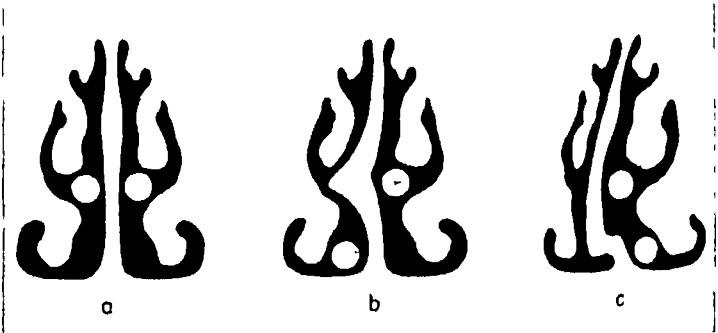


Fig 1 (a) Suction tubes are usually passed through the middle meati (b) If one middle meatus is obstructed the inferior meatal path is followed (c) If one nasal passage is obstructed both tubes are passed through the other side of the nose

Using a tongue depressor, the posterior pharyngeal wall is exposed and the suction tips adjusted so that the top perforation of each is just below the tip of the uvula (see Fig 5)

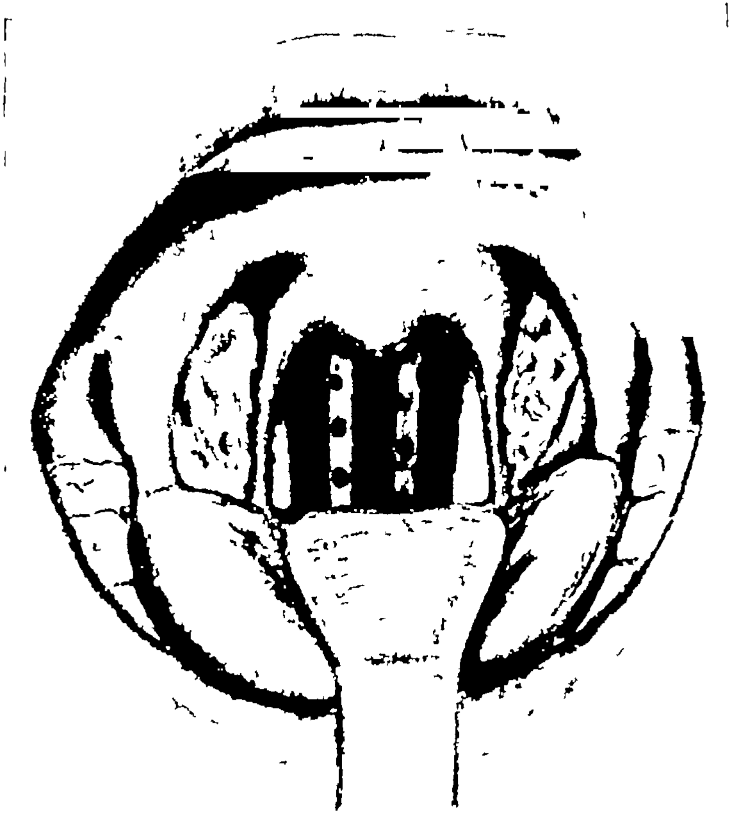


Fig 5 The tips of the suction tubes are in position Suction of the uvula is avoided by keeping the perforations of the tubes below it

The portions of the tubes extending from the nose are carried up to the forehead and are fixed to the head towel by a safety pin After picking up a piece of the towel, the pin is passed over the tubes to engage the towel again in such a manner as to apply enough pressure to the tubes to keep them from slipping The bell ends of the tubes are then attached to the arms of the glass "Y" tube Suction is turned on, and its pressure is regulated by the clamp on the large tubing (see Fig 6)

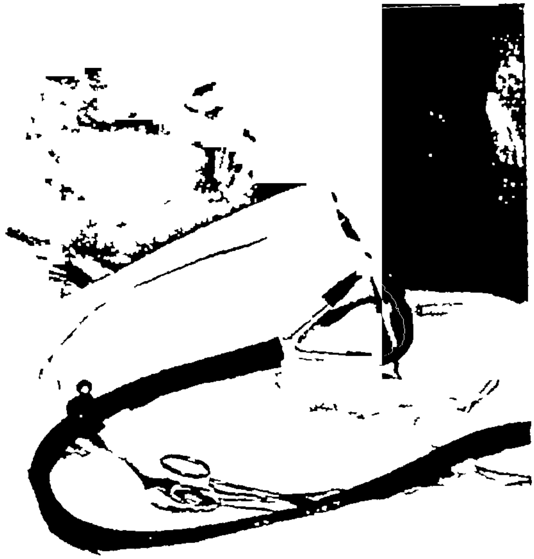


Fig 6 Nasal suction tubes and their connections are shown above Note particularly the safety pin fixation to the head towel Between this fixed point and that of the towel clip an S shaped course of the tubing permits some rotation of the head without a pull on the tubes

Infiltration Anesthesia Any technique desired by the surgeon may be employed

B The Operation

Here again, the surgeon may use the technique of his choice It has been found helpful, after one tonsil has been removed, to insert a string sponge into the fossa to control bleeding while the other tonsil is being removed Some may prefer to ligate any bleeding vessels first Before proceeding with the other tonsil, it is also advisable to remove any large stringy clots that may have collected about the perforations of the tubes

A Davis mouth gag was formerly used to keep the mouth open and the tongue out of the way But it has since been abandoned for a Weder or similar metal tongue depressor in cases where an unruly tongue must be controlled Patients prefer these to the Davis type gag because they permit intermittent relaxation of the jaw muscles

At the conclusion of the operation, the suction tubes are removed slowly through the nasopharynx so as to remove any blood that may have accumulated

When the patient is returned to his room, he is instructed to lie on one side, and not to use a head pillow for several hours This position tends to prevent aspiration of any blood

SUMMARY

In the foregoing presentation a method of continuous pharyngeal suction, combined with the placing of the patient in a certain dorsal recumbent position, has been described for use in performing tonsillectomy under local anesthesia A personal conclusion has been reached that by the use of this technique the operation is rendered safer and the inconveniences are reduced for both patient and surgeon

REFERENCES

1 OCHSNER, A and NESBIT, W Pulmonary Abscess Following Tonsillectomy *Arch Otolaryngol*, 6 330 Oct, 1927

2 IGLAUER, S Aspiration of Blood into the Larynx and Trachea During Tonsillectomy Under Local Anesthesia A Contribution to the Etiology of Lung Abscess *Ann Otol Rhinol and Laryngol* 37 231 239 Mar, 1928

3 MOORE W F Tonsillectomy Sump The Instrumental Prevention of Inspiratory Postoperative Pulmonary Abscess THE LARYNGOSCOPE 32 686 693 Sept, 1922

4 MYERSON M C A New Pharyngeal Suction Tube THE LARYNGOSCOPE, 33 455 456, June 1923

5 HUNT W M A New Suction Tube Depressor THE LARYNGOSCOPE 33 461 June 1923

6 HARA H J Aspiration in Tonsillectomy Comparative Merits of Posture and Other Factors Bronchoscopic Study of 110 Patients *Calif and West Med* 33 628 638 Sept 1930

7 BETTINGTON R H A Method for the Removal of Tonsils and Adenoids Under Local Anesthesia with the Patient in the Recumbent Position *Med Jour Australia* 1 882 883 June 22 1946

THE RELATIONSHIP OF SWIMMING AND DIVING TO SINUSITIS AND HEARING LOSS*

WILLIAM J HITSCHLER M D,
Philadelphia, Pa

INTRODUCTION

The purpose of this paper is to record data collected in order to determine the relationship of swimming and diving to sinusitis and hearing loss Two things especially aroused the author's interest in this *1* a friend once on a college diving team stated that most of his team mates were deaf, and *2* a nearby pool filled the office every summer with sinus and ear cases (Let it be said now that the friend was probably in error, and second, that the pool referred to was later proven to be greatly contaminated

The relationship between swimming and diving and sinusitis and hearing loss, or upper respiratory infection, has existed and has been recognized for years Cobb,[1] in 1908, writing on the "Menace of the Swimming Tank," stated, "Ethmoiditis and otitis media which apparently were caused directly by diving in a swimming tank — occur so often — and are often so serious, not alone in regard to the hearing, but even to the life of the patient " Mosher[2] has said "our worst cases of frontal sinus infection and osteomyelitis have followed swimming" Taylor,[3] in speaking of public bathing places, stated "aural infections — which can be attributed directly to the sports of swimming and diving" Mackenzie Brown[4] and many others, too many to enumerate, have reported similar instances

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 25 1949

*Read at the Fifty-third Annual Meeting of the American Laryngological Rhinological and Otological Society Inc Chicago Ill. April 20 1949

Various reasons have been advanced to explain why swimming and diving may cause upper respiratory disease Contaminated water, water containing irritants, or the presence of already existing disease in the swimmer are some of these Taylor[5] and Taylor and Dryenforth[6] have shown that the body temperature is lowered and that there are blood and vascular changes after the prolonged chilling due to swimming Man's lack of adaptation to immersion in water as compared to that of aquatic animals has been clearly shown[7] These animals are able to close their anterior nares and their external auditory canals, thus affording protection from the destructive action of water Aquatic animals are also well insulated, while man is not In addition to the above factors predisposing to upper respiratory infection, it is known that solutions which are either hyper- or hypotonic have a detrimental effect upon the mucous membranes

METHOD OF STUDY

It was felt that the best way to approach this subject would be to contact the swimmers and divers themselves To do this, a number of sources were employed The first and most important source was that of the colleges and universities throughout the country The athletic director or swimming coach of each of these was sent a letter explaining the nature of the study and asked if he would furnish a list of the former swimmers and divers of that college Many (48) expressed interest in the undertaking and cooperated fully Other sources were the amateur athletic union, theatrical booking agencies for professional swimmers, and leads given by the swimmers themselves To all of these swimmers was sent a form letter addressed individually It read as follows

> Dear Mr Smith
>
> I am conducting an investigation for a scientific (medical) report of the effect (if any) of swimming and diving upon the hearing and sinuses One of the most important aspects of such a study would be the opinions of the swimmers themselves

Your name has been given me by the athletic director of your college who is also interested in the results obtained If you will fill in and return the enclosed post card your cooperation will be greatly appreciated Feel free to make any additional comments

If you are able to come to the above address or to the department of prevention of deafness clinic at the Jefferson Medical College Hospital we would be glad to examine you (no charge)

Sincerely yours

Enclosed with the letter was a self-addressed and stamped post card This post card had spaces where the person could state whether he was a swimmer or a diver, and whether he had continued this activity since his college days There were spaces to check the presence of hearing loss, and whether he thought this was due to swimming and diving, not due to it, or that he was unaware of the cause There was a space to record tinnitus He then checked the presence or absence and severity of sinusitis and again its relationship to swimming and diving There was a place for comments, the swimmer's class and university

A control group was also established This, too, was mostly college alumni Their names were furnished by the secretary of the University of Pennsylvania They were graded as to age so as to correspond as nearly as possible with the experimental group To these was sent a somewhat similar letter and an enclosed post card The letter was as follows

Dear Mr Smith

I am conducting an investigation in collaboration with the Jefferson Medical College to determine the prevalence of sinusitis and hearing loss throughout the country

I have chosen college graduates for sampling inasmuch as I think their opinions would be the most accurate

If you will fill in the return enclosed post card I will greatly appreciate it Feel free to make any additional comments

A copy of the published report will be sent to you if you so desire

Sincerely yours

Note that in this letter nothing was said about swimming The return post card was also as similar as possible to the one sent the swimmers This post card contained spaces for answers to similar questions as to sinusitis and hearing loss but not mentioning swimming or diving After each was a space for stating the cause of the trouble if known, a space for comments, name, age and university

At this time, advice was sought and obtained from The Audience Research Incorporated of Princeton, N J, concerning the method of the survey They kindly furnished a report, the essence of which was that the survey was for the most part being conducted properly, but suggested, among other things, that a repeat letter be sent to a sample of both the experimental and control groups The purpose of this was to determine whether there was any weighting of the group who did not respond at first Accordingly some 500 repeat letters were sent to each group These answers were recorded separately

It soon became apparent that information other than that obtained from the post card survey would also be desirable With this in mind, special letters were sent to athletic and public health directors, well known amateur and professional swimmers, and to physicians in charge of college health Personal interviews were had with several prominent coaches and college authorities, including Mr Robert Kiphuth, swimming coach, and Drs Rogers and Philips, student health physicians, of Yale University, Dr Leroy Mercer, of the University of Pennsylvania, Mr Howard Stepp and Dr Raycroft, of Princeton, Mr Edward Kennedy, of Columbia, and others All were most cooperative and helpful In addition a few well known pediatricians were consulted

Another attempt at gaining information was made by corresponding with doctors, headmasters and coaches connected with boarding schools This approach was inspired by the work of Dr Roswell Gallagher, and by the thought that those connected with boarding schools were presumably more intimate with and hence more cognizant of the boys' activities and illnesses than those connected with the college population

Finally an effort was made to compare salt water with fresh water swimming To do this, some of the members of this Society who lived on the seacoasts were asked their opinions on the subject Many answered this query and in addition some discussed the general subject of swimming in detail These opinions are included I express my gratitude to those men without whose comments this paper would lack material of great value

RESULTS OF THE SURVEY

There were approximately 1,800 letters and return post cards sent to the former college swimmers and divers, 410, or 23 per cent, answered Five hundred repeat letters were then sent, with 123, or 25 per cent, returns

To the control group were sent 2 500 letters, 613, or 24 per cent, of these answered Likewise, 500 repeats were sent, with 89, or 18 per cent, returns

Similar letters were sent to about 170 swimmers, some of whom were professionals and some members of the Amateur Athletic Union, 75 answered

The total number of form letters with return post cards sent was 5,470, and the total number of replies at the date of writing was 1,310, or 24 per cent A few more, too late to include, were also received

Of the 1,310 replies, only those cards, with the exception of a few whose location was not known, which were completely and correctly filled out were included in the results Those discarded included those who did not give their age or class and those mentioning having one lesion, *e g* sinusitis, but omitting any check mark concerning hearing loss It could not be assumed that failure to answer meant a negative answer Due to a mistake, there were too many older people in the control group Some of these were, therefore, discarded This was done at random All over 50 years of age were eliminated, although separate reference is made to this group With these deletions, the total was reduced from 1 310 to 919 480 swimmers and divers and 439 controls

LOCATONS

1 Comparisons between experimental and control groups
2 Percentage of positives in various localities

	Experimental			Control			Total		
	No	No Pos	% Pos	No	No Pos	% Pos	No	No Pos	% Pos
South	97	47	48	152	77	51	249	124	50
Philadelphia	77	12	55	183	79	43	260	121	47
North ..	296	118	40	99	40	40	395	158	40
No location noted ..	10			4			14		

Unfortunately, much of the South group came from the border areas, such as Maryland, Virginia, West Virginia and Washington, D C, and so cannot be regarded as the deep South, however, a more detailed break down, although containing too few cards to be significant, did not show any appreciable difference

It is evident that the experimental and the control groups were not well selected for geographical similarity, the experimental containing more from the North and the control more from the South and Philadelphia, however, the per cent of positives in each locality is nearly the same for each group

Also, it is evident that the per cent of positives in each location, regardless of group, is similar We may conclude, therefore, that the amount of disease shown in this survey does not differ as to locality

The positives in the experimental group were divided into three subgroups, according to what was thought to be the cause of the trouble First were those who claimed their trouble was from swimming and diving, second, those who did not know, and third, those who thought the trouble was not due to swimming and diving

CAUSE OF TROUBLE IN EXPERIMENTAL GROUP

	Positive 1 Trouble from Swimming and Diving	Positive 2 Don t Know	Positive 3 Not from Swimming and Diving
	No	No	No
Sinusitis	54	35	60
Hearing loss and tinnitus	11	17	11
Both	13	10	2
Total	78 (11m) or 16%	62 (3m) or 13%	73 (4m) or 15%

The number in each of these groups is approximately the same There are 78, or 16 per cent, of the swimmers and divers who thought the sport was the cause of their sinusitis

LOCATONS

1 Comparisons between experimental and control groups
2 Percentage of positives in various localities

	Experimental			Control			Total		
	No	No Pos	% Pos	No	No Pos	% Pos	No	No Pos	% Pos
South	97	47	48	152	77	51	249	124	50
Philadelphia	77	42	55	183	79	43	260	121	47
North	296	118	40	99	40	40	395	158	40
No location noted	10			4			14		

Unfortunately, much of the South group came from the border areas, such as Maryland, Virginia, West Virginia and Washington, D C, and so cannot be regarded as the deep South, however, a more detailed break down, although containing too few cards to be significant, did not show any appreciable difference

It is evident that the experimental and the control groups were not well selected for geographical similarity, the experimental containing more from the North and the control more from the South and Philadelphia, however, the per cent of positives in each locality is nearly the same for each group

Also, it is evident that the per cent of positives in each location, regardless of group, is similar We may conclude, therefore, that the amount of disease shown in this survey does not differ as to locality

The positives in the experimental group were divided into three subgroups, according to what was thought to be the cause of the trouble First were those who claimed their trouble was from swimming and diving, second, those who did not know, and third, those who thought the trouble was not due to swimming and diving

CAUSE OF TROUBLE IN EXPERIMENTAL GROUP

	Positive 1 Trouble from Swimming and Diving	Positive 2 Don t Know	Positive 3 Not from Swimming and Diving
	No	No	No
Sinusitis	54	35	60
Hearing loss and tinnitus	11	17	11
Both	13	10	2
Total	78 (11m) or 16%	62 (3m) or 13%	73 (7m) or 15%

The number in each of these groups is approximately the same There are 78, or 16 per cent, of the swimmers and divers who thought the sport was the cause of their sinusitis or hearing loss, and 62, or 13 per cent, who did not It seems reasonable to suppose that at least some of these people contracted sinusitis or hearing loss from swimming or diving Shown in parentheses are the number of lesions checked as marked rather than slight There are more by far in the first group This finding is suggestive only Further analysis of the severity of the trouble will follow

SEVERITY OF TROUBLE

	No		% of Pos (213)	% of Whole (480)
		Experimental		
Slight	195		92	42
Marked	18	16 sin 2 h l or tin	8	4

	No		% of Pos (200)	% of Whole (439)
		Control		
Slight	163		82	37
Marked	37	35 sin 2 h l and tin	18	8

There is a much greater proportion of marked trouble in the control group than in the experimental group These findings are statistically significant and will be discussed later

As may be recalled, the post card asked whether the person was a swimmer, diver, or both, in an effort to determine if one or the other sport was more responsible for the disease

SWIMMERS VERSUS DIVERS

	No	No Pos	% Pos
Swimmers only	351	141	40
Did both	86	44	51
Divers only	42	27	64

The swimmers had the least and the divers had the most infections It might be proper to consider the ones who participated in both as diving some, but less than the divers group, and it is seen that their percentage of trouble lies between the others In other words, the percentage of trouble is proportional to the amount of diving Such figures, however, are only suggestive and are not statistically significant

Another question asked was whether the person had continued the activity after his college career Without resorting to figures, it may be said that there was no difference between those who did and those who did not

The factor of age must be considered The following table shows the age comparison between the experimental and the control groups and the percentage of positives in those groups

AGE AND DISEASE

Age	Col. 1 No	2 %	3 No Pos	4 % Pos	5 % of the Age Group Pos
		Experimental 480 Total			
18 30	164	34	72	15	44
31-40	223	46	90	19	40
41 50	93	19	51	11	55
Over 50	6	1	3	1	50
		Controls 439 Total			
18 30	149	34	65	15	44
31-40	211	48	97	22	46
41 50	79	18	38	9	48
Over 50	65	15			23

Column 2 shows that the percentage of each age in both the experimental and control groups is almost identical In other words, the two groups were chosen properly in this regard The age factor, therefore, did not influence the results As has been stated, the over 50 group was not included except when specifically noted

In column 4 it is seen that there is a close similarity for each age between the percentage of positives of the whole in the experimental and control groups, *i e*, 15 per cent in the 18-30 for both, 19 per cent in the experimental and 22 per cent in the control for 31-40, etc

Column 5 shows the percentage of positives of those in that age group in each of the groups There is no significant trend, the per cent positives do not differ as to age

Age and kind of disease is shown in the table below It was thought worthwhile to determine whether the separate lesions, *i e*, sinusitis or hearing loss, varied according to the age Both experimental and control groups were combined for this study as the figures of each were similar

TABLE A

	No In Age Group	No Sinus Lesions	%
18 30	313	122	39
31 40	434	162	37
41 50	172	76	44
Over 50	71	18	25

TABLE B

	Total No Lesions	No Sinus Lesions	%
18 30	155	122	79
31 40	216	162	75
41 50	109	76	69
Over 50	43	18	42

This table (A) does not show any marked trend, unless the over 50 group could be regarded as significant, however, if figured another way (see Table B), the percentage of total number of lesions which are sinus lesions, we find a slight decrease in the sinus lesions through all groups as the age advances It is not statistically significant

The next table shows a similar break down of the hearing loss and tinnitus combined

AGE AND HEARING LOSS

	No in Age Group	No Hearing Loss Lesions	% of Hearing Loss	Total No Lesions	% of Total
18-30	313	39	11	155	21
31-40	434	54	12	216	25
41-50	172	23	19	109	31
Over 50	71	25	35	43	38

Either way this is figured, *i e*, per cent of whole age group or per cent of total number of lesions, we note an increase of hearing loss with advancing age, however, again the differences in the three younger age groups are more suggestive than statistically significant

Reasons given in the controls as causes of sinusitis under "comments" were interesting "Climate," usually with the adjective "damp," "humid" or "cold," led by far This opprobrium was used equally for all localities Other causes included smoke and smoking, nasal deformities, dust, allergy and swimming Causes given for hearing loss were too varied to enumerate

Occasionally there was an amusing reply A college swimming coach wrote that, to avoid infection, "all swimmers before entering the pool, should dip their fingers into the water and dampen their ear lobes — we have found that it is very successful"

OPINIONS FROM SPECIAL GROUPS

1 *Swimming Coaches and Athletic Directors*

Eleven coaches and directors, all with years of experience, wrote interesting replies concerning swimming and upper respiratory infections Most (seven) thought that no harm resulted from swimming and diving, two, that there was less infection among swimmers than in nonswimmers, and one thought there possibly was more infection They did not differentiate between the effects of swimming and diving, however, more than half qualified their opinions, stating that, in order to avoid infection from swimming and diving, *1* proper breathing was essential, *2* there must be proper attention to diet (vitamins, etc), rest and general hygiene, including avoidance of chilling after leaving the warm gymnasium, and wearing rubbers on wet days As one said, "I must always keep after the boys" Several mentioned that swimming and diving would aggravate sinusitis if already present, and one conceded that perhaps the lack of infection among the college swimmers was due to the fact that they were pretty well screened out, *i e*, only healthy ones swam

The general trend of their opinions, *i e*, the denial of infections from swimming and diving, was most striking Several experienced coaches stated that they did not recollect ever having had to prohibit a man from entering a meet because of upper respiratory infection It must be remembered, however, that coaches depend upon the sport for their livelihood and, therefore, might be partial They also work only with the healthy athlete

Saunders[8] had some interesting replies to questionnaires answered by 18 swimming instructors attached to various athletic clubs Most of these felt that there was very little infection among the swimmers and divers, although one or two reported considerable Saunders, himself, both an expert swimmer and otolaryngologist, thought that most disease was contracted by two groups beginners, and expert divers and polo players The former because of improper breathing, and the latter because of the excess strain placed upon their respiratory tracts

2 College Health Physicians

College health physicians were almost but not so unanimous or emphatic in their opinions that swimming and diving caused little trouble Dr Raycoft, of Princeton, stated that he has been in close contact with swimmers and divers, including Olympic swimmers, for years, and that he knew of no one seriously inacapacitated from upper respiratory infection or hearing loss Dr Leroy Mercer of Pennsylvania agreed Others felt there was a slight amount of infection incurred

WATER POLO

If water sports ever caused infection, it would be in the game of water polo Here the participants are submerged much of the time and may not have time to breathe properly before submerging They are also subject while submerged to blows upon the ears Nearly all consulted admitted occurrences of traumatic nature of the eardrum Opinion was divided, however, as to the game's being responsible for upper respiratory infection Several doctors (Roger and Philips) and one well known coach (Stepp) stated that there was some infection caused, while others (Mercer and Kennedy) denied this One friend of mine, a former player and now a doctor, had to stop because of marked sinusitis resulting directly from it, while another, also experienced and still playing the game, stated he had never contracted an upper respiratory infection He did, however, admit to several traumatic ruptures of the drums, but attached little significance to them, and said that his hearing was perfect

Regardless of individual opinions, water polo has been discontinued as a college sport, mainly because of health

3 *Boarding School Personnel*

Dr Roswell Gallagher,[9] of Phillips Andover Academy, recently studied the incidence of upper respiratory infection among those at his school who did and did not frequent the pool He found 14 per cent more upper respiratory infections among the former Many of these, however, were untrained bathers

Headmasters, coaches or doctors connected with 12 other similar institutions replied Five of these denied any trouble from swimming and diving Two felt there would be no trouble providing the swimmers had a normal upper respiratory tract One felt that swimming does cause infection, and four would not offer an opinion In other words, there was a more or less denial of trouble

4 *Pediatricians*

A few well known pediatricians were informally consulted on this problem They were unanimous that among children the incidence of upper respiratory infections from swimming and diving was noticeable or even marked The reasons were obvious, and included the anatomy of the child's upper respiratory tract, the playing in water, chilling and general disregard for hygiene so characteristic of children It is to be remembered that most of the reported cases of severe infection attributable to swimming were among the young

5 *Individual Opinions of Expert Swimmers*

There were many individual opinions from professionals and Amateur Athletic Union members These letters often were detailed as to the swimming habits of the individual, how to avoid trouble, and his general impression of the sport The great majority expressed high praise for it Many stated they had been swimming and diving for years without even any sign of upper respiratory infection attributable to it Some even claimed water sports prevented infection

It would seem probable that the more enthusiastic swimmers would be the ones to offer their opinions This would modify the importance of their statements

SALT WATER VERSUS FRESH WATER

While considering swimming in general, a question presented itself which seemed worthwhile investigating It concerned the difference, if any, between the effects of swimming in salt or in fresh water By salt water is meant sea water or its equivalent

Fenton,[10] in 1923, showed there was a destructive action of fresh water on the nasal mucosa which resulted in lowered local resistance to bacteria As he pointed out, the osmotic action, driving water into the tissues, produced edema, acidosis, loss of ciliary action and eventual cell death Proetz[11] found that all ciliary action ceased at a concentration of 0 2 or 0 3 per cent salt the cells became clouded, and that this cessation of motion was permanent On the other hand, he found the stoppage to occur in hypertonic solutions at 4 to 5 per cent, which is about 1 per cent stronger than ocean water, but in this case the action commenced again if the tissue were immersed in normal saline Most (75 per cent) of the rabbits investigated by Stark[12] developed purulent sinusitis Proetz[11] showed that there was also a slowing of the cilia with cold water

In addition to the local effect on the tissues, there is another factor to be considered The edema, mentioned by Fenton, which is produced by fresh water, will temporarily at least cause any water and bacteria which have entered the sinuses or middle ear cavities to remain there, producing further local damage and possible pus formation On the other hand, hypertonic solutions, such as ocean water, will shrink the tissues and allow easy evacuation

A practical consideration of some importance is the fact that most salt water swimming is done in the open ocean where there is little or no contamination, usually bright sunlight, and plenty of beach to run on to keep warm, however, if there is contamination in salt water, upper respiratory trouble does result, as was stated by Pinkerton [13] In his locality, sewage from a nearby city will, under certain conditions, reach a popular bathing beach He noted a definite increase of upper respiratory disease when this occurred

Twenty otolaryngologists, all members of this Society, were kind enough to reply to my queries Besides opinions upon the question of salt versus fresh water, other thoughts relating to swimming as a cause of upper respiratory infection were offered

Eleven of the 20 thought that fresh water swimming was more harmful, while one thought that ocean beach bathing was so, due to the entrance of sand into the nasal passages Seven thought there was no difference, and one ventured no opinion Thus there was a predominance of opinion in favor of salt water swimming

Other factors mentioned leading to upper respiratory infection follow Heading the list was the contamination of the water Twelve mentioned this Infection already present in the upper respiratory tract of the swimmer was mentioned nine times Diving and under water swimming were next in importance, followed by the presence of irritants, chilling, exposure, exhaustion, and finally improper breathing Three felt that swimming caused little or no trouble, and one wondered if salt water bathing might not improve some of the chronic nasal conditions

It is interesting to compare the viewpoint of the otolaryngologist in regard to swimming and upper respiratory infection with that of the swimming coach

COMMENTS

The post card survey is open to several justifiable criticisms *1* the exact age of the swimmers is not known The class rather than the age was asked for in the experimental group The age then had to be computed from the class, assuming that graduation was at age 22, *2* the polled perhaps did not know what was meant by sinusitis Sinusitis is a vague term to the layman, and slight sinusitis can be and is claimed by so many that its significance is probably small, *3* the geographical location of the two groups is not similar Break down of this, however, does not alter the results, *4* the sample is a fairly small one, subject to error because of its size, *5* a control group consisting entirely of athletes would have been preferable to the one used Finally, whether it be called a criticism or a limitation, the post card survey only embraces the trained adult swimmer, not the child, or the "bather" The names sent by the colleges were those listed as letter men or at least swimming squad men To achieve this proficiency in swimming or diving, the person would presumably be one who had not contracted severe upper respiratory disease in the past Also, when trying out for the team, those with or contracting any marked upper respiratory infection would not be allowed to participate Then, too, when once accepted as a candidate, the swimming and diving is done under strict supervision Coaches emphasize their watchdog care The swimmers and divers are taught to breathe so as to keep as much water as possible out of their noses They practice a limited time, do not "play" or sit on the cold marble and become chilled

It is evident, then, that the survey deals with but a small selected group, however, any disease contracted by those in this group would be included in the survey This covers perhaps one to three years of swimming at college, and all subsequent infection For such a group, the survey is probably reasonably accurate

Several of the statistical results need some comment first is the close similarity between the experimental and the control groups

It is known that water enters the nasal passages of even the expert swimmer It is noteworthy, therefore, that so little apparent harm resulted from such frequent immersion, even in this selected group, and may be regarded as a tribute to the coaches and trainers Perhaps the supposition that athletes enjoy better health than nonathletes, as is claimed by some,[14] is also partly responsible, or it could be said that these findings indicate that athletes do enjoy better health or, more precisely, resist infection more than do nonathletes The lesser number of severe lesions in the experimental group tended to substantiate this

Another possible explanation for the similarity of the two groups might be that infection even among bathers is rare and would not appreciably affect statistics If this be true, one would have to disregard the 78 who stated their trouble came from water sports

The large percentage of positives in all groups may be due, as has been mentioned, to failure to identify sinusitis Psychic factors or inclusion of other ailments, such as allergy, also must be considered The hearing loss plus tinnitus figures (13 per cent) are high and difficult to account for, but hearing loss alone, however (9 to 10 per cent), is only slightly above other estimates[15]

Also, it is probable that a direct questionnaire such as this would elicit a maximum number of positive responses

When the number of severe lesions in the experimental group is considered, one notes that there were 11 among the 78 who stated their trouble came from swimming and diving, and only seven among the 125 comprising the rest This would suggest that lesions among the swimmers due to swimming were more apt to be severe ones

The opinions of the special groups varied according to the group in question, and these opinions must be weighed in this respect Coaches see the healthy, trained athlete, otolaryngologists and pediatricians, the sick patient It is to be remembered that these groups, except for the coaches, are concerned mainly with the great mass of bathers, rather than with the trained swimmers

CONCLUSIONS

1 The incidence of sinusitis and hearing loss among healthy adult trained swimmers was no greater than among unselected college graduates

2 There was less severe upper respiratory infection among the swimmers and divers than among the controls

3 In the experimental group, the figures suggested that lesions contracted from swimming and diving were more apt to be severe than those contracted from other causes

4 Geographical location bore no definite relation to the incidence of disease

5 Coaches and other swimming experts saw little infection, school and college physicians and boarding school personnel saw more, otolaryngologists still more, and pediatricians, most

The large percentage of positives in all groups may be due, as has been mentioned, to failure to identify sinusitis Psychic factors or inclusion of other ailments, such as allergy, also must be considered The hearing loss plus tinnitus figures (13 per cent) are high and difficult to account for, but hearing loss alone, however (9 to 10 per cent), is only slightly above other estimates[15]

Also, it is probable that a direct questionnaire such as this would elicit a maximum number of positive responses

When the number of severe lesions in the experimental group is considered, one notes that there were 11 among the 78 who stated their trouble came from swimming and diving, and only seven among the 125 comprising the rest This would suggest that lesions among the swimmers due to swimming were more apt to be severe ones

The opinions of the special groups varied according to the group in question, and these opinions must be weighed in this respect Coaches see the healthy, trained athlete, otolaryngologists and pediatricians, the sick patient It is to be remembered that these groups, except for the coaches, are concerned mainly with the great mass of bathers, rather than with the trained swimmers

CONCLUSIONS

1 The incidence of sinusitis and hearing loss among healthy adult trained swimmers was no greater than among unselected college graduates

2 There was less severe upper respiratory infection among the swimmers and divers than among the controls

3 In the experimental group, the figures suggested that lesions contracted from swimming and diving were more apt to be severe than those contracted from other causes

4 Geographical location bore no definite relation to the incidence of disease

5 Coaches and other swimming expert — little infection,
school and college physicians and boa nnel
saw more, otolaryngologists still
most

6 Salt water swimming was considered safer than fresh water swimming

7 Factors emphasized leading to the contraction of disease were lack of proper training and supervision, immaturity, the presence of already existing upper respiratory infection, and contaminated water

SUMMARY

An attempt was made to determine the relationship of swimming and diving to sinusitis and hearing loss A letter and post card survey was conducted among some 900 college graduates, roughly half of whom were trained swimmers Other information was obtained from correspondence and interviews with swimming coaches, school and college personnel, otolaryngologists and pediatricians The relative merits of fresh versus salt water swimming were discussed

BIBLIOGRAPHY

1 Cobb, C M Menace of the Swimming Tank *Boston Med and Surg Jour*, CLIX 9 1908

2 Mosher, H P Osteomyelitis of the Frontal Bone *Jour A M A* 107 942 Sept. 19 1936

3 Taylor, H M The Cause and Prevention of Otolgic Conditions Following Swimming and Diving *Jour A M A* 81 349 Aug 4 1923

4 Brown Mackenzie Frontal Sinusitis *Ann Otol Rhinol and Laryngol* 50 2 435 June 1941

5 Taylor H M Sinusitis and Swimming *Jour A M A* 85 7 July 4 1925

6 Taylor, H M and Dyrenforth L Y Chilling of the Body Surfaces Its Relationship to Aural and Sinus Infections *Jour A M A* 111 1744 Nov 5 1938

7 Taylor, H M Otitis and Sinusitis in the Swimmer With Emphasis on Man s Lack of Adaptation to Aquatic Environment *Jour A M A* 113 891-894 1939

8 Saunders G C Sinusitis and Otitis in Swimmers *Amer Jour Hygiene* X 1 253 July 1929

9 Gallagher J R Swimming Pools Their Relation to Illness *N Eng Med Jour* 238 899 June 24 1948

10 Fenton R. A. Sinusitis from Swimming *Ann Otol Rhinol and Laryngol* 32 526 June 1923

11 Proetz, Arthur The Effects of Certain Drugs Upon Living Nasal Ciliated Epithelium *Ann Otol Rhinol and Laryngol* 43 450 June 1934

12 Stark W B Irrigations with Aqueas Solution Their Effect on the Membranes of the Upper Respiratory Tract of the Rabbit. *Arch Otolaryngol* 8 47 July 1928

13 Pinkerton F J Personal communication

14 Gallagher J R and Brouha L Physical Fitness Its Evaluation and Significance *Jour A M A* 125 834 July 22 1944

15 Macfarlan Douglas Personal communication

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

The coming Section Meetings of the American Laryngological, Rhinological and Otological Society, Inc , are to be held as follows

Eastern Section Hotel Statler, New York, N Y , Jan 5, 1950

Council Meeting Hotel Statler, New York, N Y , Jan 6, 1950

Combined Meeting, Southern and Middle Sections Peabody Hotel, Memphis, Tenn , Jan 16-17, 1950

Western Section Medical Society Building, Los Angeles, Calif , Jan 21-22, 1950

The 1950 Spring Meetings will be held at the Hotel Mark Hopkins in San Francisco, Calif , as follows

American Board of Otolaryngology, May 16-20, inclusive

American Otological Society, Inc , May 21-22

American Laryngological Association, May 23-24

The American Laryngological, Rhinological and Otological Society, Inc , May 25-27, A M

The American Broncho-Esophagological Association, May 25-26, P M

Please make your Hotel Mark Hopkins reservations at once by writing to Mr Carl J Wilson, Assistant Manager, San Francisco Convention and Tourist Bureau, 200 Civic Auditorium, San Francisco, Calif , and enclose a deposit of $10 made payable to the Hotel Mark Hopkins In return you will receive a hotel reservation confirmation The limited facilities available make early reservations important

Members and guests desiring to go on special Pullman cars "with the gang" should write immediately to Dr Walter H Theobald, 307 North Michigan Avenue, Chicago 1, Ill , Chairman of the Transportation Committee

Dr C Stewart Nash, Secretary

SECOND PAN AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY — MONTEVIDEO-BUENOS AIRES, JAN 8-15, 1950

EXECUTIVE COMMITTEE

President Prof Justo M Alonso

Vice-Presidents Prof Elias Regules, Dr Juan Carlos Munyo, Prof Juan Carlos Oreggia

Secretary General Prof Pedro Regules

Secretary of Interior Prof Hector Rebagliatti

Secretary of Exterior Dr Julio Cesar Barani

Secretary of Exhibit Dr Enrique Apolo

Secretary of Publicity Dr Jaime Sala Lopez

Treasurer Dr Alberto Santoro Vecino

Assistant Treasurer Dr Juan Carlos Munyo, Jr

Delegate in Argentine Republic Prof Juan Manuel Tato

Delegate in Mexico Dr Ricardo Tapia Acuña

Delegate in Cuba Dr Pedro Hernandez Gonzalo

Delegate in the U S A and Canada Dr Chevalier L Jackson

An interesting and instructive program has been arranged

Subscription—$10, or its equivalent in Uruguayan money

The following week (Jan 16-21) there will take place in Montevideo and Buenos Aires, operative demonstrations for those who wish to attend

Travel arrangements should be made immediately through Thomas Cook & Sons or Pan American Airways

All those interested in attending this Congress should communicate at once with the delegate in the U S A. and Canada, Dr Chevalier L Jackson, 3401 North Broad Street, Philadelphia 40, Pa

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

The coming Section Meetings of the American Laryngological, Rhinological and Otological Society, Inc, are to be held as follows

Eastern Section Hotel Statler, New York, N Y, Jan 5, 1950

Council Meeting Hotel Statler, New York, N Y, Jan 6, 1950

Combined Meeting, Southern and Middle Sections Peabody Hotel, Memphis, Tenn, Jan 16-17, 1950

Western Section Medical Society Building, Los Angeles, Calif, Jan 21-22, 1950

The 1950 Spring Meetings will be held at the Hotel Mark Hopkins in San Francisco, Calif, as follows

American Board of Otolaryngology, May 16-20, inclusive

American Otological Society, Inc, May 21-22

American Laryngological Association, May 23-24

The American Laryngological, Rhinological and Otological Society, Inc, May 25-27, A M

The American Broncho-Esophagological Association, May 25-26, P M

Please make your Hotel Mark Hopkins reservations at once by writing to Mr Carl J Wilson, Assistant Manager, San Francisco Convention and Tourist Bureau, 200 Civic Auditorium, San Francisco, Calif, and enclose a deposit of $10 made payable to the Hotel Mark Hopkins In return you will receive a hotel reservation confirmation The limited facilities available make early reservations important

Members and guests desiring to go on special Pullman cars "with the gang" should write immediately to Dr Walter H Theobald, 307 North Michigan Avenue, Chicago 1, Ill, Chairman of the Transportation Committee

Dr C Stewart Nash, Secretary

SECOND PAN AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY — MONTEVIDEO-BUENOS AIRES, JAN 8-15, 1950

EXECUTIVE COMMITTEE

President Prof Justo M Alonso

Vice-Presidents Prof Elias Regules, Dr Juan Carlos Munyo, Prof Juan Carlos Oreggia

Secretary General Prof Pedro Regules

Secretary of Interior Prof Hector Rebagliatti

Secretary of Exterior Dr Julio Cesar Barani

Secretary of Exhibit Dr Enrique Apolo

Secretary of Publicity Dr Jaime Sala López

Treasurer Dr Alberto Santoro Vecino

Assistant Treasurer Dr Juan Carlos Munyo, Jr

Delegate in Argentine Republic Prof Juan Manuel Tato

Delegate in Mexico Dr Ricardo Tapia Acuña

Delegate in Cuba Dr Pedro Hernández Gonzalo

Delegate in the U S A and Canada Dr Chevalier L Jackson

An interesting and instructive program has been arranged

Subscription—$10, or its equivalent in Uruguayan money

The following week (Jan 16-21) there will take place in Montevideo and Buenos Aires, operative demonstrations for those who wish to attend

Travel arrangements should be made immediately through Thomas Cook & Sons or Pan American Airways

All those interested in attending this Congress should communicate at once with the delegate in the U S A and Canada, Dr Chevalier L Jackson, 3401 North Broad Street, Philadelphia 40, Pa

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETS AT ST LOUIS, SEPT 28, 29, 30, 1949

The Fourteenth Annual Meeting of the Mississippi Valley Medical Society will be held at the Jefferson Hotel, St Louis, Mo, Sept 28, 29, 30, 1949, under the presidency of Dr Alphonse McMahon, of St Louis University At the recent current meetings of the Society and board of directors, the following officers were elected Dr Nathaniel G Alcock, Iowa City, Iowa, President-elect, Dr Wendell G Scott, St Louis, Mo, First Vice-President, Dr Charles F Harmon, Springfield, Ill, Second Vice-President, Dr John I Marker, Davenport, Iowa, Third Vice-President, Dr Harold Swanberg, Quincy, Ill, Secretary-Treasurer, Dr Ralph McReynolds, Quincy, Ill, Accounting Officer

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Home Study Courses in the basic sciences related to ophthalmology and otolaryngology, offered as a part of the educational program of the American Academy of Ophthalmology and Otolaryngology, will begin on Sept 1 and continue for a period of 10 months Registrations must be completed before Aug 15 Detailed information and application forms may be secured from Dr William L Benedict, the executive secretary of the Academy, 100 First Avenue Building, Rochester, Minn

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp 580 Fifth Ave New York 19 N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St Chicago Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac, Beltone Symphonette

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St., Chicago Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl., New York 5 N Y

Electroear Model C

Manufacturer American Earphone Co Inc., 10 East 43rd St. New York 17 N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co Inc, 50 W 29th St. New York 1 N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co Inc. North Third St. Minneapolis Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp 1 W 34th St. New York N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co 727 Atlantic Ave Boston 11 Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co, 4602 Nicollet Ave, Minneapolis 9, Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories, 815 S Hill St Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4

Manufacturer Otarion Hearing Aids, 159 N Dearborn St, Chicago, Ill

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)

Manufacturer Paraphone Hearing Aid, Inc, 2056 E 4th St, Cleveland Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale, Chicago 14 Ill

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone, Radioear Permo-Magnetic Multipower—report not yet published

Manufacturer E A Myers & Sons, 306 Beverly Rd, Mt Lebanon Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp, 6001 W Dickens Ave, Chicago Ill

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp, 101 Tremont St., Boston 8, Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc , 2454 S Michigan Ave Chicago, Ill

Televox Model E

Manufacturer Televox Mfg Co , 117 S Broad St Philadelphia 7, Pa

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex, Inc , Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc , 1627 Pacific Ave , Dallas 1 Tex.

Trimm Vacuum Tube No 300

Manufacturer Trimm, Inc 400 W Lake St., Libertyville, Ill

Unex Model "A", Unex Midget Model 95, Unex Midget Model 110

Manufacturer Nichols & Clark Hathorne Mass

Vacolite Model J

Manufacturer Vacolite Co , 3003 N Henderson St Dallas 6 Tex.

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc. 120 Broadway, New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave Chicago Ill

All of the accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer, 20 Charlesgate, West Boston 15, Mass
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3 N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A Fenton, 906 Medical Arts Bldg, Portland, Ore
Secretary Louis H Clerf, 1530 Locust St., Philadelphia 2, Pa
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin, 384 Post St., San Francisco 8, Calif
Secretary Dr C Stewart Nash, 708 Medical Arts Building, Rochester, N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

Eastern Section, Hotel Statler, New York N Y, Jan 5 1950
Council Meeting Hotel Statler, New York City Jan 6, 1950
Combined Meeting Southern and Middle Sections Peabody Hotel Memphis, Tenn, Jan 16 17, 1950
Western Section, Medical Society Building, Los Angeles, Calif Jan 21 22, 1950

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward 104 E Market St., Charlottesville, Va.
Secretary Dr James M Robb, 641 David Whitney Bldg, Detroit, Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens, 35 E 70th St, New York, N Y
President Elect Dr J Mackenzie Brown, 1136 W 6th St., Los Angeles, Calif
Executive Secretary Dr William L Benedict Mayo Clinic Rochester Minn
Meeting Palmer House Chicago Ill, Oct 9 14 1949

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley, 384 Post St., San Francisco, Calif

Secretary Treasurer Dr Joseph Hampsey, 806 May Bldg, Pittsburgh 22 Pa.

PAN AMERICAN ASSOCIATION OF OTO-RHINO LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L Jackson, 255 S 17th St., Philadelphia, Pa

Second Pan American Congress of Oto Rhino-Laryngology and Broncho-Esophagology Montevideo, January, 1950

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President Dr LeRoy A. Schall, 243 Charles St, Boston, Mass

Secretary Dr Edwin N Broyles, 1100 N Charles St. Baltimore 1 Md

Meeting Mark Hopkins Hotel, San Francisco, Calif May 1950

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Warren A Wilson

Secretary Treasurer Dr Victor Goodhill.

Chairman of Section on Ophthalmology Dr George Landegger

Secretary of Section on Ophthalmology Dr Harold B Alexander

Chairman of Section on Otolaryngology Dr Alden H Miller

Secretary of Section on Otolaryngology Dr Leland R. House

Place Los Angeles County Medical Association Bldg, 1925 Wilshire Blvd., Los Angeles, Calif

Time 6 P.M, fourth Monday of each month from September to May, inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner 115 E 61st Street, New York 21 N Y

Secretary Dr Norman N Smith, 291 Whitney Avenue, New Haven 11 Conn.

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Garnett P Morison Charles Town W V

First Vice-President Dr Charles T St. Clair Jr Bluefield W Va

Second Vice-President Dr Arthur C Chandler Charleston W Va

Secretary Dr Melvin W McGehee 425 Eleventh St. Huntington 1 W Va.

Treasurer Dr Frederick C Reel Charleston W Va

Directors Dr Eugene C Hartman Parkersburg W Va Dr Ivan Fawcett, Wheeling W Va

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave. North Nashville 3 Tenn.

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg, Atlanta 3, Ga.

Vice-Chairman Dr V R. Hurst, 315 N Center St., Longview, Tex.

Secretary Dr Alston Callahan, 908 S. Twentieth St., Birmingham 5, Ala.

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St., Philadelphia, Pa.

Vice-President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore, Pa.

Treasurer Dr Harry P Schenck, 1912 Spruce St., Philadelphia, Pa.

Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa.

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Reinaldo de Villiers

Vicepresidente Dr César Cabrera Calderin

Secretario Dr José Xirau

Tesorero Dr Alfredo M Petit.

Vocal Dr José Gross

Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier

First Secretary Dr Gabriel Porto

Second Secretary Dr Roberto Barbosa

Librarian Treasurer Dr Leoncio de Souza Queiroz

Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino

Vice-Presidente Dr Luis E Olsen

Secretario Dr Eugenio Romero Diaz

Tesorero Dr Juan Manuel Pradales

Vocales Dr Osvaldo Suárez, Dr Nondier Asis R Dr Jorge Bergallo Yofre

THE
LARYNGOSCOPE.

VoL LIX AUGUST, 1949 No 8

CAROTID PAIN[*]

JEROME A HILGER, M D ,
St Paul, Minn

Irregularity in autonomic balance produces many clinical pictures ranging from Raynaud's disease to neurovascular arthropathies in the extremities and from peptic ulcer to ulcerative colitis in the gastrointestinal system, however, clinical manifestation of autonomic imbalance is perhaps most common in the cranial segments of the sympathetic and parasympathetic systems It is exhibited principally in alterations in the vasomotor control of the carotid arterial tree

The carotid arterial tree is a dynamic set of muscular and elastic tubes which vary in their calibre according to the immediate environmental need The variations in lumen are regulated through autonomic nervous system control Autonomic innervation is distributed to the peripheral arteries through the many terminal nerve trunks of the head region as well as by way of the plexi on the major vessels It is probable that the arteriolar level is more richly innervated than the arterial level[13-15] From the functional and clinical standpoint the behavior of major arterial branches is of minor importance in comparison with the arteriolar periphery

---

[*]Presented as Candidate s Thesis to American Laryngological Rhinological and Otological Society Inc 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 26 1949

Angiospasm at the arterial level can be effected through sympathetic impulse and may be of moderate clinical importance The existence of primary vasodilatation at arterial level, on the other hand, has been a controversial subject Both parasympathetic and sympathetic vasodilator innervation exists, but vasodilator influence in vessels larger than arteriole size is of doubtful clinical importance

Angiospasm in vessels of arteriolar calibre is mediated through sympathetic innervation and is of major clinical moment The influence of abrupt reduction in arteriolar blood flow upon a single capillary has been the subject of extensive study [1-5] The ischemic capillary undergoes dilatation, and transudation results There is considerable evidence to support the thesis that this simple functional vascular change is the basis of the wheal formation and edema of the allergic reaction [6] The allergic state is inherent in an individual with an unstable and unbalanced autonomic nervous system Arteriolar spasm precipitated through the disordered control of this system may result in whealing anywhere in the organism

Arteriolar spasm effected through sympathetic overbalance is frequently confined to one segmental arterial bed The change in the major segmental artery supplying an arteriolar periphery which has undergone angiospasm as a unit must be one of vasodilatation This passive dilatation resulting from peripheral obstruction results in pain in the affected arterial segment

The walls of the carotid artery and its many branches are supplied generously with sensory nerve endings which ramify from adjoining sensory nerve trunks Most of the fibres involved in the conduction of afferent impulses from the peripheral arteries reach the spinal cord and brain stem without traversing the sympathetic trunks [8, 10] Stimulation of these nerve endings is effected by stretch of the arterial wall and is appreciated as pain The pain will vary with the degree of dilatation and can be extraordinarily severe It is characteristically a deep-seated pain in contradistinction with the more superficial searing pain of primary nerve trunk or ganglion origin It commonly is accentuated with the pulse and hence is described as throbbing If the arterial segment is superficial, steady supportive pressure over the area frequently gives comfort in spite of the fact that indiscreet, jabbing palpation shows extreme tenderness along the arterial course Deeper arterial segments, particularly those housed in bony canals, give throbbing, bursting pain identical with that arising from an empyema of a paranasal sinus

The ramifications of one or many carotid branches may undergo the functional change producing angiodilating pain in the stem artery It may occur on one or both sides or may alternate There is a characteristically habitual pattern of dilatation in the individual case which gives a usual localization of pain This may vary with time and circumstance, however The typically hemicranic migraine frequently changes the character and location of his vascular pain in the course of years The unilateral histaminic cephalgic alters in severity and place Always, however, there is a basic segmental character to the abnormal neurovascular habit, though changes in location and degree may develop slowly through the years to produce a varied clinical picture

The mild usual degrees of angiodilatation show no objective change at the site of pain Palpable dilatation in superficial vessels may be noted in severer degrees of change, and areas of tenderness may persist long after the acute and painful phase subsides Pain may originate from the dilatation of any arterial segment, superficial or deep, however, when the arteriolar periphery beyond is dammed by vasospasm

A common site of dilatation is at the carotid bifurcation The patient usually complains of the recurrent and abrupt onset of unilateral sore throat with the appearance of a "gland" in the neck There is no evidence of inflammation The bifurcation is palpable as a firm, extremely tender mass at the hyoid level It pulsates—an important diagnostic point Usually the tonsils have been removed in previous efforts to alleviate the recurrences of sore throat

Atypical facial neuralgic pain, which is atypical because it does not correspond to sensory nerve distribution, in reality usually is angiodilating pain and is in no sense a neuralgia The internal maxillary, superficial temporal and postauricular pain of sphenopalatine neuralgia usually arises from the pain endings in the arterial walls of those branches of the external carotid as they dilate Cocainization of the sphenopalatine ganglion produces relief only if the spastic arteriolar bed is under control of the sympathetic fibres under blockage or if sufficient intranasal vasoconstrictor is administered to give systemic absorption and direct constrictive influence on the dilated arterial trunk Removal or destruction of the sphenopalatine ganglion is an incomplete sympathectomy at best and has little to recommend it in the relief of cranial vascular pain because the sympathetic innervation of the carotid branches does not centralize well at the sphenopalatine

The surgical trauma of intranasal septal surgery for removal of spurs irregularities and impingements gives temporary relief to angiodilating pain because trauma admittedly alters autonomic balance for a time The same may be said for removal of the edematous and hyperplastic mucosa of the paranasal sinuses at the periphery of the spastic arteriolar bed This temporary pain relief is unfortunate It is the foundation of the promiscuous intranasal surgery of the past many decades Since it does not alter the basic unstable nature of the autonomic mechanism producing the pain, the surgical relief is transient and intranasal surgery has fallen into lay and medical disrepute

Edema beyond the arteriole follows severe arteriolar angiospasm and presents objective evidence of swelling without inflammatory cause This in the internal maxillary arterial distribution results in nasal and paranasal sinus mucosa edema and hypersecretion, in the periorbital vessels it results in conjunctival injection, in the superior thyroid artery it can produce severe intracapsular swelling, in the external maxillary, edema of the lip develops, in the infraorbital, tenderness and edema at the foramen is pronounced, in the transverse facial, edema of the lower lid may be recurrent, in the ascending pharyngeal, pharyngeal edema and severe sore throat simulate pharyngitis, in inferior dental and alveolar branches the dull, pulsating throb of apical abscess is mimicked by edema of the pulp, etc

The character of one's autonomic nervous system is a matter of inheritance Unbalanced function, therefore, tends to familial distribution The basic function of the autonomic system is that of adjusting the organism to its environment Any individual may encounter environmental factors which place undue stress upon this mechanism For some, this occurs more readily than for others Even exposure to certain food or inhalant substances may, through autonomic mediation, create an antigen — antibody response in them which on subsequent exposure results in allergic neurovascular phenomena The same may occur as a disordered response to physical factors of temperature and humidity and light in the environment This reaction of physical sensitivity is elicited particularly upon abrupt alterations in the surrounding temperature and humidity The most common precipitor of disordered autonomic response, however, lies not in these tangible environmental factors but, rather, in the individual's own emotional response to his environment In the same individual, all of these factors may bear causatively on his neurovascular distresses An exhaustive family and personal medical history is the principal means of airing these relationships

CASE HISTORIES

A 59 year-old woman had experienced recurrent severe pain in the right side of the neck and head for the past year It had been unrelieved by migraine medications or treatments for sinus disease She had had numerous thorough medical examinations without findings of organic disease For a week the pain had intensified and become persistent This change followed a crisis in a domestic situation which had been troubled for several years This fact was not given due attention at the time of first history and examination because there were several salient objective findings which drew the red herring of inflammatory disease across the trail. The thyroid gland was noted to be intensely swollen and tender in a manner suggestive of acute thyroiditis there was bilateral doughy swelling in the supraclavicular spaces and there was a 2 cm mass beneath the angle of the mandible suggestive of an enlarged cervical lymph gland. Pain was intense and throbbing and unrelieved with mor phine There was no fever and hemogram was normal Four days intense therapy with penicillin and sulfadiazine brought no improvement It was then felt that, in the absence of evidence of true infection one must believe this remarkable clinical picture to result from neurovascular change alone This belief was strengthened when it was noted that the cervical 'gland" pulsated strongly and appeared in reality to be the bifurcation region of the carotid artery and that the right sided head pain originated in the course of palpably tender and dilated superficial temporal, external maxillary and transverse facial arteries Eight hundred milligrams of tetraethylammonium chloride given intramuscularly within two hours gave remarkable relief from a pain which had previously been unresponsive to repeated injections of 16 mg of morphine When the autonomic block at ganglion level was maintained by repeated injections of the tetraethylammonium salt, pain relief was maintained and the edema of the thyroid gland and the supraclavicular spaces disappeared within 24 hours It was noteworthy that edema confined within the capsule of the gland evoked extreme pain and tenderness while that in the loose and unlimited areolar tissues of the supraclavicular depressions caused little discomfort When the tetraethylammonium chloride was withheld in a trial maneuver two days after the original injection pain reappeared in six hours and edema became objectively apparent in nine hours When the pain was again controlled the patient was allowed to regulate the frequency of injection according to the reappearance of discomfort The period of comfort increased, and in a week further autonomic block was unnecessary It was feared that return to her previous domestic situation would precipitate recurrence In spite of psychiatric help, this did occur and she was readmitted to the hospital in one month and again six weeks thereafter with identical symptoms and findings and in both instances prompt relief was obtained from autonomic blockade

A 52 year old male had been continuously disabled for five years with recurrent episodes of severe left cervical and postauricular pain which usually initiated within a period of minutes a violent attack of left vasomotor labyrinthitis with roaring tinnitus sharp decrease in hearing acuity vertigo nausea and vomiting During the same period chronic vasomotor cochlearitis had resulted in severe impairment of hearing acuity in the right ear and a constant buzzing tinnitus He had consulted 25 doctors in the five years The patient had had chronic vasomotor rhinitis and vasodilating pains in varying parts of the head for much of his adult lifetime He had a parental and sibling background of vasomotor instability He was acutely physically sensitive and active rhinitis and vascular pain was frequently precipitated by physical exposure The usual aggravant for his pain and inner ear episodes however was an emotional upset or period of nervous tension When the pain appeared the carotid artery was seen to dilate along its length to amazing size On admission to hospital for study one such episode occurred and the admitting physician noted the sausage like cervical swelling as a probable lymphangiomatous mass but of surprising tenderness To his amazement it disappeared in an hour leaving only a somewhat prominent carotid artery moderately sensitive to pressure

On this and one other admission to hospital it was necessary to control severe vasomotor labyrinthine attacks and persistent angiodilating pain with tetraethylammonium chloride

It is extremely difficult to root out neurovascular habits of this duration and severity Medicines have a limited useful ness With psychiatric care, regular use of the arteriolar dilating properties of nicotinic acid, occasional barbiturate sedation and peripheral neural block with pyribenzamine, the frequency of angiodilating pain and vasomotor labyrinthine attacks has diminished to a point at which the patient has resumed work and is in good part rehabilitated

A 58-year-old woman had had recurrent attacks of maxillary sinusitis on the left side for one year She had had a great deal of local sinus treatment and repeated courses of penicillin therapy by both injection and inhalation Her acute attacks characteristically developed abruptly with pain in the left maxillary sinus area and the left upper teeth and a moderate rhinorrhea and nasal congestion on the left side She at no time had evidences of suppuration in the way of purulent discharge or fever She frequently with the more severe attacks developed swelling which was objectively evident in the soft tissues of the canine fossa region. On her first examination she was in the throes of such an attack and there was objective evidence of edema in the canine fossa which extended modestly upward into the left nasomaxillary groove There was marked tenderness to pressure over the infraorbital foramen There was a mild turbinal edema and a modest excess mucous discharge in the left nasal space The sinuses transluminated clearly and there was no evidence of mucopus in the nose or in the nasopharynx. She was afebrile

It was suspected that the patient s recurrent difficulty was not inflammatory in nature and careful history elicited the fact that her sinus attacks were precipitated almost invariably by a period of difficulty with her husband An injection of 1cc of ergotamine tartrate intramuscularly gave her rather prompt relief of the pain, though the tenderness in the edematous area and over the infraorbital foramen remained pronounced for some period of time Subsequent comfort was provided by the daily use of nicotinic acid and the early use of 50 mg doses of pyribenzamine at the slightest sign of angiodilatation On two occasions however the patient awakened with the pain well established and the edema already forming and pyribenzamine was found to be ineffective as a means of relief In the last six months after establishing a satisfactory adjustment in her domestic affairs she has had no recurrences of the attacks which previously had averaged one to two severe episodes per month

A 35 year-old woman was first seen for a chronic vasomotor rhinitis and right chronic vasomotor cochlearitis She had had a marked physical sensitivity and dust sensitivity since she was 17 years of age which expressed itself in the form of active rhinitis particularly during the inclement seasons of the year and during the winter heating season A year before examination she had developed tinnitus and progressive hearing impairment in the right ear She had had no vertigo Her audiogram showed an average 30 db loss of an inner ear type with a marked involvement in the high tones Her general examination showed nothing of moment.

House dust desensitization and daily use of nicotinic acid during the inclement periods of the year gave her satisfactory relief from her rhinitis and reduced the frequency of tinnitus from that of constant annoyance to occasional periods of tinnitus usually precipitated by physical exposure or fatigue particularly at the time of her menstrual period

She was subsequently seen following death of a member of her family The complaint at this time was severe sore throat, of four days duration on the right side and pain and swelling localized over the mandible on the right side, and involving the right upper lip What the patient had taken for a spreading infection in reality showed no inflammatory signs whatsoever The bifurcation of the carotid artery on the right side was found to be markedly prominent and pulsating and had given the patient the impression that she had a glandular swelling in her neck The external maxillary artery in its course over the ramus of the mandible was very prominent and showed marked pulsation and tenderness in its course The region of the artery in the soft tissues of the right cheek and to its terminals in the upper lip was palpable between finger and thumb as a cord like swelling with quite pronounced edema surrounding The patient obtained relief from ergotamine tartrate intramuscularly in 1 cc dose and thereafter resumed the use of her nicotinic acid and was given, in addition, a 50 mg dose of pyribenzamine to take four times a day There has been no recurrence since that time

A 42 year old woman had had intense pain for a period of two months It extended from the right cervical area beneath the angle of the mandible to the temporal area well forward to the region above the right eye and postauricularly radiated downward to the trapezius She had had treatment for sinusitis, including cocainization of the sphenopalatine ganglion on several occasions without relief She had a normal neurological examination on two occasions Neurological consultation was thought advisable because of the intensity of her head pain A general physical examination had shown nothing worthy of remark X rays of the cervical spine and skull were normal

Objectively the one finding of moment was a markedly dilated carotid bifurcation and dilatation and tenderness along the course of the superficial temporal artery, including its anterior temporal division The course of the postauricular artery, as far as it could be palpated at sufficiently superficial point was tender as with the superficial temporal artery

Questioning as to the precipitating cause demonstrated the fact that the patient had been confined to a small town for several months because of her husband's business and was under constant emotional stress because of her lack of ability to accept the change from the city The nature of the origin of her pain was discussed with her and with the combined use of nicotinic acid and pyribenzamine she obtained prompt relief and has had no recurrences since that time

A 39 year old woman suffered recurrent sore throats for a period of four years The sore throat was usually unilateral, though the side frequently alternated It was her impression that frequently the sore throats were precipitated by fatigue or by physical exposure — either occurring on a damp day or after exposure to drafts by a fan or air conditioning unit She had an asthmatic mother and her father had had a constant catarrhal annoyance throughout the inclement period of the year for as long as she could remember She herself had had seasonal pollenosis in her teens and recurrent migraine headache since 20 years of age The sore throat which was her present primary complaint was never attended by fever or other objective inflammatory sign other than a regularly recurring gland like tender mass beneath the angle of the mandible on the symptomatic side She had had her tonsils removed two years previously without influence on her sore throat

When examined during the acute phase of a typical episode of sore throat, it was noted that there was no evidence of mucosal inflammatory disorder There was a moderate edema of the pharyngeal mucosa and the gland like swelling was apparent in typical form It was identifiable as the bifurcation of the carotid artery — a rather fusiform pulsating very tender swelling 1 5 cm. in diameter

Abstinence from smoking with its vasoconstrictive influences proper living routine and frequent use of oral nicotinic acid have lessened the frequency of sore throat to the point where it is an infrequent occurrence rather than a regularly recurrent annoyance She still feels that imaginary tonsil tags underlie her disorder

SUMMARY

The character of an individual's autonomic nervous system is a matter of inheritance, hence autonomic imbalance tends to familial distribution

Vasomotor control of the carotid arterial tree is vested in the autonomic nervous system

The arteriolar periphery of the carotid ramifications is the important functional level Spasm at this level occurs segmentally and results in capillary damage and edema distally and in angiodilatation proximally

Angiodilatation of the carotid artery and its branches is a common cause of pain in the regions of the head and neck.

BIBLIOGRAPHY

1. Abell, R. G and Schenck, H P *Jour Immunol.*, 34 195-213 Mar 1938

2 Lewis, Thomas The Blood Vessels of the Human Skin and Their Responses Shaw and Sons Std. 1927

3 Keogh The Anatomy and Physiology of Capillaries Yale University Press, 1930

4 Hooker, D R. *Physiol Rev* 1 112 140 Jan 1921.

5 Landis, E. M. The Passage of Fluid Through the Capillary Wall Harvey Lecture Nov 19, 1936

6 Ratner Bret Allergy Anaphyloxis and Immunitherapy Williams and Wilkins 1943 pp 633-653

7 Kuntz Albert Autonomic Nervous System. Lea and Febeger 1945 pp 494-495

8 Burget, G E Pathway for Visceral Afferent Impulses from the Forelimb of the Dog *Amer Jour Physiol.*, 97 249 253 1931

She was subsequently seen following death of a member of her family The complaint at this time was severe sore throat, of four days' duration, on the right side and pain and swelling localized over the mandible on the right side, and involving the right upper lip What the patient had taken for a spreading infection in reality showed no inflammatory signs whatsoever The bifurcation of the carotid artery on the right side was found to be markedly prominent and pulsating and had given the patient the impression that she had a glandular swelling in her neck The external maxillary artery in its course over the ramus of the mandible was very prominent and showed marked pulsation and tenderness in its course The region of the artery in the soft tissues of the right cheek and to its terminals in the upper lip was palpable between finger and thumb as a cord like swelling with quite pronounced edema surrounding The patient obtained relief from ergotamine tartrate intramuscularly in 1 cc dose and thereafter resumed the use of her nicotinic acid and was given, in addition, a 50 mg dose of pyribenzamine to take four times a day There has been no recurrence since that time

A 42 year old woman had had intense pain for a period of two months It extended from the right cervical area beneath the angle of the mandible to the temporal area well forward to the region above the right eye and postauricularly radiated downward to the trapezius She had had treatment for sinusitis, including cocainization of the sphenopalatine ganglion on several occasions without relief She had a normal neurological examination on two occasions Neurological consultation was thought advisable because of the intensity of her head pain A general physical examination had shown nothing worthy of remark X rays of the cervical spine and skull were normal

Objectively the one finding of moment was a markedly dilated carotid bifurcation and dilatation and tenderness along the course of the superficial temporal artery including its anterior temporal division The course of the postauricular artery, as far as it could be palpated at sufficiently superficial point was tender as with the superficial temporal artery

Questioning as to the precipitating cause demonstrated the fact that the patient had been confined to a small town for several months because of her husband s business and was under constant emotional stress because of her lack of ability to accept the change from the city The nature of the origin of her pain was discussed with her, and with the combined use of nicotinic acid and pyribenzamine she obtained prompt relief and has had no recurrences since that time

A 39 year old woman suffered recurrent sore throats for a period of four years The sore throat was usually unilateral, though the side frequently alternated It was her impression that frequently the sore throats were precipitated by fatigue or by physical exposure — either occurring on a damp day or after exposure to drafts by a fan or air conditioning unit She had an asthmatic mother and her father had had a constant catarrhal annoyance throughout the inclement period of the year for as long as she could remember She herself had had seasonal pollenosis in her teens and recurrent migraine headache since 20 years of age The sore throat which was her present primary complaint was never attended by fever or other objective inflammatory sign other than a regularly recurring gland like tender mass beneath the angle of the mandible on the symptomatic side She had had her tonsils removed two years previously without influence on her sore throat.

CANCER OF THE NOSE
TREATMENT AND PLASTIC REPAIR*

JOHN B ERICH, M D ,†
Rochester, Minn

The treatment of external cancers of the nose is essentially the same as the treatment of skin cancers elsewhere about the face, however, there are two points of difference First, unless extremely small, the removal of a skin lesion on the nose by excision leaves a wound which cannot be closed by primary suturing without causing unsightly distortion of the nose Second, the margins of a recurring, postirradiated carcinoma are much less determinable on the nose than in most other situations about the face, this is so because the cancer cells tend to divide and spread along the periosteum or perichondrium under normal skin far beyond the apparent external limits of the growth

Three factors lead to poor results in the treatment of cancer of the nose First is insufficient or ineffective treatment by individuals who are completely ignorant of the nature of the lesion or who are inexperienced in the care of such growths Second is incomplete treatment based on the fear of producing an external deformity If cancers of the nose are going to be cured, deformities are bound to occur in a great many cases regardless of the type of treatment employed Third is delay in radical removal of such growths until some conservative measure, such as the use of an escharotic or the use of a little Roentgen-ray or radium therapy, has first been tried

---

*Read at the meeting of the Middle Section American Laryngological Rhinological and Otological Association Inc Iowa City Iowa Jan 17 1949

†From the Section on Laryngology Oral and Plastic Surgery Mayo Clinic Rochester Minn

Editor's Note This ms received in Laryngoscope Office and accepted for publication, March 14 1949

9 MOORE, R M, and MOORE, R. C Peripheral Course of Sensory Nerves Supplying Arteries of Lower Extremity *Proc Soc Exp Biol and Med*, 29 919 921, 1932

10 MOORE, R. M, and SINGLETON, A. G Studies on the Pain Sensibility of Arteries II—Peripheral Paths of Afferent Nerons from the Arteries of Extremities and of the Abdominal Viscera *Amer Jour Physiol* 104 259 266, 1933

11 KUNTZ, A Nerve Fibres of Spinal and Vagus Origin Associated with the Cephalic Sympathetic Nerves *Ann Otol, Rhinol and Laryngol* 43 50 67, 1934

12 HIRSCH, L Ueber die Nervenversorgung des Gefasse im Hinblick auf die Probleme der Periarteriellen Sympathktomis *Arch Klin Chir* 137 281 288, 1925

13 WOOLLARD, H H, and PHILLIPS, R. The Distribution of Sympathetic Fibres in the Extremities *Jour Anat*, 67 18 27, 1933

14 WOOLARD, H H The Peripheral Sympathetic Nervous System *Brit Jour Surg*, 23 425-432, 1926

15 CHOROBSKI, J, and PENFIELD, W Cerebral Vasodilator Nerves and Their Pathway from the Medulla Oblongata *Arch Neurol and Psychiat*, 28 1257-1289, 1932

I am not going to enter into a discussion of the relative merits of surgical measures and irradiation in the primary care of malignant tumors of the nose Let it simply be said here, that regardless of what method is employed, let it be radical enough to cure the condition There is only one good opportunity to effect a cure and that is at the time of the primary treatment I should like to say, however, that a recurring carcinoma which has been previously treated by irradiation is not going to be cured by further irradiation, such cases should be considered as surgical problems without further delay

Practically all malignant tumors involving the external nose are basal cell or squamous cell epitheliomas, and the former type occurs much more frequently than the latter At the clinic, squamous cell epitheliomas are graded on a basis of 1 to 4, Grade 1 being the least malignant and least radiosensitive, and Grade 4 the most malignant and most radiosensitive This form of grading is based on Broders' classification of the histologic appearance of malignant lesions and can be accomplished only by a competent pathologist It is our opinion at the clinic that low grade lesions, which are more or less radioresistant, should be treated surgically, that is, either by surgical excision or the use of surgical diathermy (electrocoagulation) High grade lesions, which are extremely radiosensitive, are best treated by irradiation

There is no one form of treatment which is suitable in all cases The method of treatment should be in keeping with the type of growth that is present Many physicians treat basal cell epitheliomas with success by irradiation, however, at the clinic, we prefer to remove them surgically, in the same manner as the low grade squamous cell epitheliomas are removed A disc of tissue with a wide margin of normal tissue around the epithelioma is cut out This is sent to the pathologist who freezes the tissue, makes slides and gives an immediate report If the growth is low grade, if it has had no previous treatment, and if it has been removed with an adequate margin of normal tissue surrounding it, there is no

Such treatment not only may seriously change the rate of growth of the lesion but also may make the condition incurable, furthermore, it has been repeatedly demonstrated that inefficient primary treatment may actually raise the degree of malignancy of the tumor; for instance, many basal cell epitheliomas by such treatment are changed to more active squamous cell lesions

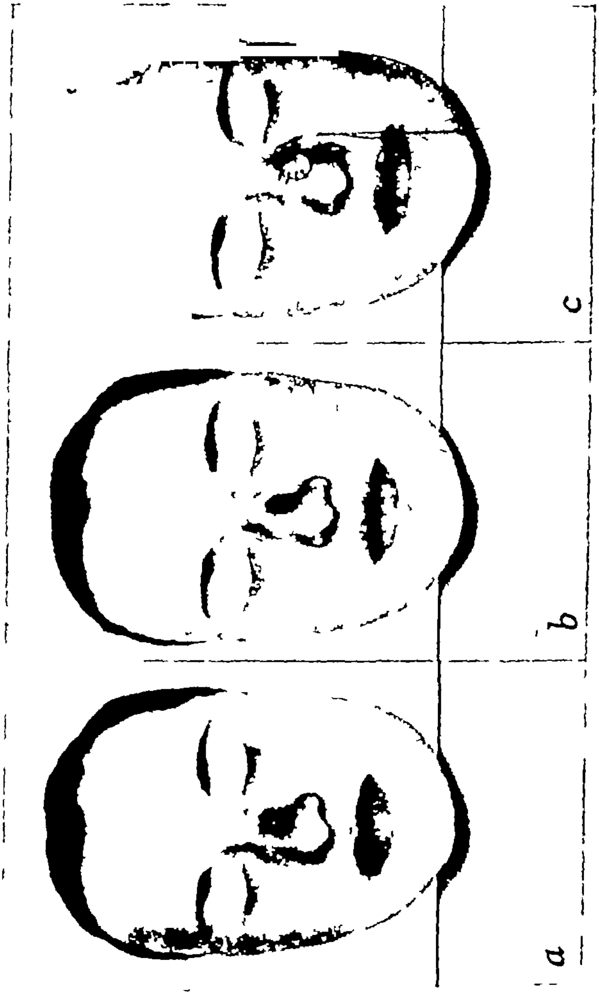


Fig 1 Nasal skin flap and full-thickness skin graft for repair of small perforations of the nose (a) Flap left attached along defect is elevated and sutured back (b) Two weeks later the flap is again elevated turned over and into the defect as shown and sutured down around the edges of the defect to form a lining (c) A full-thickness skin graft is obtained from behind the ear and is laid into the defect and over the flap

I am not going to enter into a discussion of the relative merits of surgical measures and irradiation in the primary care of malignant tumors of the nose Let it simply be said here, that regardless of what method is employed, let it be radical enough to cure the condition There is only one good opportunity to effect a cure and that is at the time of the primary treatment I should like to say, however, that a recurring carcinoma which has been previously treated by irradiation is not going to be cured by further irradiation, such cases should be considered as surgical problems without further delay

Practically all malignant tumors involving the external nose are basal cell or squamous cell epitheliomas, and the former type occurs much more frequently than the latter At the clinic, squamous cell epitheliomas are graded on a basis of 1 to 4, Grade 1 being the least malignant and least radiosensitive, and Grade 4 the most malignant and most radiosensitive This form of grading is based on Broders' classification of the histologic appearance of malignant lesions and can be accomplished only by a competent pathologist It is our opinion at the clinic that low grade lesions, which are more or less radioresistant, should be treated surgically, that is, either by surgical excision or the use of surgical diathermy (electrocoagulation) High grade lesions, which are extremely radiosensitive, are best treated by irradiation

There is no one form of treatment which is suitable in all cases The method of treatment should be in keeping with the type of growth that is present Many physicians treat basal cell epitheliomas with success by irradiation, however, at the clinic, we prefer to remove them surgically, in the same manner as the low grade squamous cell epitheliomas are removed A disc of tissue with a wide margin of normal tissue around the epithelioma is cut out This is sent to the pathologist who freezes the tissue, makes slides and gives an immediate report If the growth is low grade, if it has had no previous treatment, and if it has been removed with an adequate margin of normal tissue surrounding it, there is no contraindication to an immediate repair of the defect When the loss of tissue is extremely small, the edges of the wound often can be approximated without distorting the contour of the nose, however, most nasal wounds which follow the removal of a carcinoma are too large to be closed by simple approximation, instead, they require coverage with a free skin

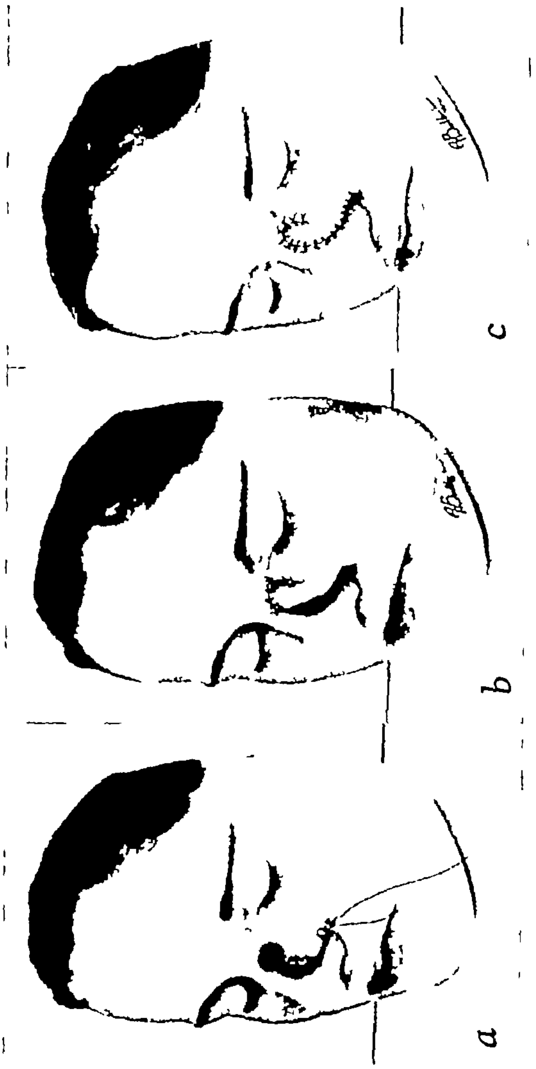


Fig – Simple rotation of a contiguous nasal flap for repair of small perforations (a) The flap is elevated lined with a skin graft and sutured back in place (b) Two weeks later the flap is elevated advanced and sutured around the defect The lower part of the wound can be closed if a small triangular piece of skin is removed below the flap (c) Final result graft For this purpose, we usually employ a full-thickness skin graft from behind the ear, which has a better color and texture than skin grafts acquired elsewhere about the body

If a low grade epithelioma on the nose is recurring and particularly if it has been treated previously by irradiation, it is very difficult to tell the exact extent of the growth because the cancer cells often spread along the periosteum or perichondrium far beyond the apparent limits of the tumor Under such circumstances, the tumor should be removed widely by electrocoagulation If surgical diathermy is used, the probability of the growth's recurring is much less than if sharp dissection is employed Electrocoagulation leaves a sloughing wound which requires three or four weeks to heal, if the nasal bones are exposed, a sequestrum forms which must be removed in two or three months The use of surgical diathermy for small epitheliomas on the nose often leaves a wound which heals with inconspicuous scarring, however, the removal of large malignant tumors cannot help but result in deformity of the nose

An epithelioma of the nose which is extremely high grade is, in general, more satisfactorily treated by irradiation than by surgical measures Such therapy consists in the insertion of radon seeds, the use of a radium plaque or Roentgen therapy

The treatment of malignant tumors of the nose is bound to result in deformities in a great many cases Such deformities may consist in conspicuous scarring, in a hole or perforation through the nose or in a loss of a large part of the nose Patients often are embarrassed by such external deformities and are just about as eager to have the defect repaired as they were to have the malignant tumor cured In most instances, we are of the opinion that plastic repair of defects of the nose which follow the removal of a malignant tumor should be deferred for at least one year after the treatment of the cancer If after a year's time there is no recurrence of the lesion, it is fairly safe for one to proceed with plastic reconstruction

A small semicircular flap is elevated adjacent to the perforation in one or two stages Eventually, it is turned with its raw surface up into the defect Subsequently, the mucous

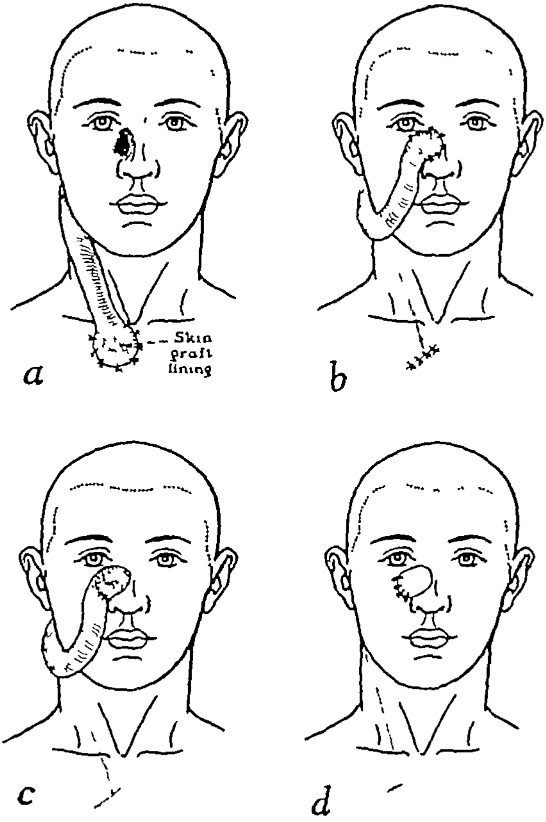


Fig 6 Cervical tube flap (a) The lower extremity of the tube flap which has previously been prepared is partially elevated and lined with a shave skin graft. The skin graft will form the lining for the reconstructed part. (b) Ten days later the lower end of the cervical tube flap is elevated and attached to the margins of the defect on the right side of the nose (c) Two weeks later the tube is cut half-way across at the outer margin of the defect This incision is sutured (d) One week later the unused part of the tube is detached from the reconstructed part and also from the neck and discarded.

membrane at the margins of the defect and the edge of the flap are sutured together A full-thickness skin graft behind one ear is dissected and inlaid into the defect to make an epithelial covering

If one wishes to avoid the use of an external full-thickness skin graft, the same type of perforation mentioned in the foregoing paragraph can sometimes be corrected by advancing a simple contiguous flap over the defect (see Fig 2) The flap, however, must be lined with a free skin graft

In general, my colleagues and I prefer to use a flap elevated on the forehead and scalp for the repair of all defects about the nose unless the forehead is scarred or unless the defect is small enough to be repaired by a contiguous flap Forehead flaps require less time in preparation, they are less likely to slough, they offer less difficulty in preparation and give better cosmetic results than do any of the tube flaps, however, forehead flaps do have the distinct disadvantage of producing more or less conspicuous scarring on the forehead This usually is of not great consequence in women who can style their hair to cover the scarred area on the forehead, but in men it often is most undesirable As previously stated, forehad flaps cannot be used when the skin in this region is scarred and they are of no use in a defect which requires fat as well as skin for reconstruction

Generally we employ the sickle-shaped temporal flap for partial defects about the nose The loop-shaped supraorbital flap and the midline sickle-shaped flap are reserved mainly for total reconstruction of the nose or for repair of the nasal tip

The sickle-shaped temporal flap (see Fig 5) is the most useful of the forehead flaps for repair of partial defects of the nose This graft gives a very good cosmetic result and leaves less visible scarring on the forehead than is produced by any of the other forehead flaps This sickle-shaped temporal flap can be extended back into the scalp to give it any desired length, it makes use of the bay of skin on the side of the forehead, which is the most inconspicuous area on the forehead When this flap is transferred to a defect, and this applies to all of the forehead flaps, the denuded donor surface on the scalp and forehead is covered with a thin-shave skin graft Such a free graft protects the denuded surface, and contraindication to an immediate repair of the defect When the loss of tissue is extremely small, the edges of the wound often can be approximated without distorting the contour of

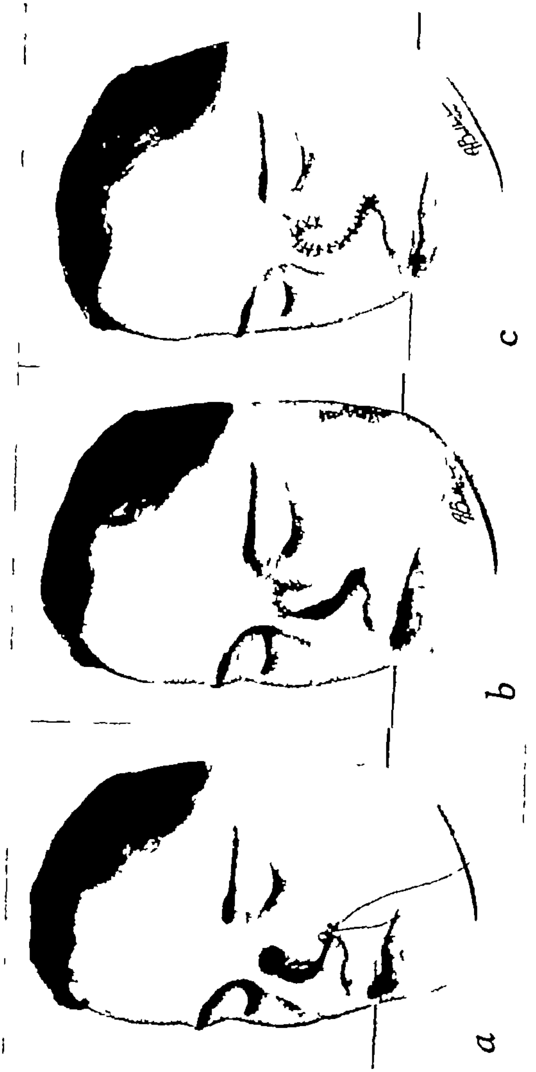


Fig — Simple rotation of a contiguous nasal flap for repair of small perforations (a) The flap is elevated lined with a skin graft and sutured back in place (b) Two weeks later the flap is elevated advanced and sutured around the defect The lower part of the wound can be closed if a small triangular piece of skin is removed below the flap (c) Final result

the nose, however, most nasal wounds which follow the removal of a carcinoma are too large to be closed by simple approximation, instead, they require coverage with a free skin graft For this purpose, we usually employ a full-thickness skin graft from behind the ear, which has a better color and texture than skin grafts acquired elsewhere about the body

If a low grade epithelioma on the nose is recurring and particularly if it has been treated previously by irradiation, it is very difficult to tell the exact extent of the growth because the cancer cells often spread along the periosteum or perichondrium far beyond the apparent limits of the tumor Under such circumstances, the tumor should be removed widely by electrocoagulation If surgical diathermy is used, the probability of the growth's recurring is much less than if sharp dissection is employed Electrocoagulation leaves a sloughing wound which requires three or four weeks to heal, if the nasal bones are exposed, a sequestrum forms which must be removed in two or three months The use of surgical diathermy for small epitheliomas on the nose often leaves a wound which heals with inconspicuous scarring, however, the removal of large malignant tumors cannot help but result in deformity of the nose

An epithelioma of the nose which is extremely high grade is, in general, more satisfactorily treated by irradiation than by surgical measures Such therapy consists in the insertion of radon seeds, the use of a radium plaque or Roentgen therapy

The treatment of malignant tumors of the nose is bound to result in deformities in a great many cases Such deformities may consist in conspicuous scarring, in a hole or perforation through the nose or in a loss of a large part of the nose Patients often are embarrassed by such external deformities and are just about as eager to have the defect repaired as they were to have the malignant tumor cured In most instances, we are of the opinion that plastic repair of defects of the nose which follow the removal of a malignant tumor should be deferred for at least one year after the treatment of the cancer If after a year's time there is no recurrence of the lesion, it is fairly safe for one to proceed with plastic reconstruction

Areas of dense scar tissue which are conspicuous or be improved by excision of the main portion of the sca leaves a raw surface which must be replaced with a fr graft, preferably a full-thickness skin graft from behi ear

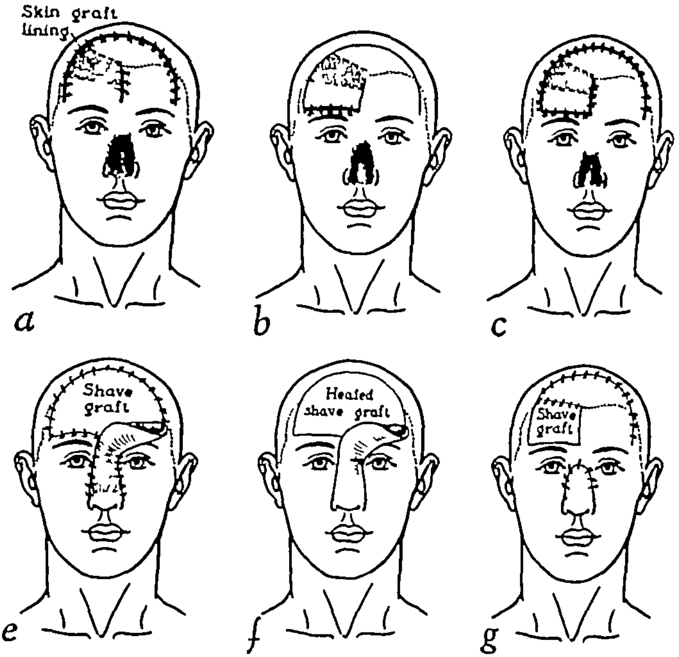


Fig 3 Steps in the delayed elevation and transference of a loop shaped supraorbital flap (a) The flap is completely elevated and undermined as indicated by the solid lines The dotted area represents a thick-shave skin graft which is inserted with its raw surface up to act as a lining when the flap is transferred to reconstruct the nose After the lining is in place the flap is sutured back in position as indicated (b) Ten days later one pedicle is cut across above the brow to stimulate the vessels in the remaining pedicle to become larger The wound is sutured (c) Ten days later the entire pedicle flap is elevated and sutured back in position to stimulate the blood supply (d) Ten days later the flap is brought down and folded in such a manner as to form nostrils and a columella The resultant denuded surface on the forehead is completely covered with a shave skin graft as indicated (e) Two weeks later the pedicle is cut half-way across as indicated and sutured back in position (f) One week later the pedicle is completely severed at the upper margin of the defect. The unused part of the flap is returned to the forehead after that part of the free skin graft which covers its bed has been excised

Small defects involving the ala, columella or the free edge of the nostril can be repaired effectively by free composite grafts of skin and cartilage taken from the ear or by a wedge of tissue taken from the lobe of the ear This technique consists in excising a segment of the free border of the ear or the lobe and transferring this piece of tissue to the defect on the nose Usually the defect must be changed by sharp dissection into a sort of wedge-shaped or rectangular loss of tissue, and the transplant from the ear must be inlaid into it The use of free transplants from the ear is very satisfactory for small defects in the areas described, but this form of repair has a very limited degree of usefulness for defects following the removal of a carcinoma This is so because the tissues adjacent to the defect have either been irradiated or are badly scarred, under either circumstance, the blood supply in the tissues is so poor as to prohibit the use of a free composite graft

If the tissues around a defect have been irradiated or are badly scarred, one must resort to the use of a pedicle flap of skin if sloughing of the transplant is to be avoided Shave and full-thickness grafts are completely detached from the donor site and maintain their viability only through the vascular supply of the bed of tissue in which they are placed A transferred flap of skin, on the other hand, has its own blood supply through its pedicle, which is not severed until enough new blood vessels have grown between the edges of the defect and the graft to establish adequate circulation in the flap

Two types of pedicle flaps can be employed for the correction of defects about the nose simple or tubed The simple "open" flap is constructed as a flat flap of tissue and usually is elevated in situations that permit direct transference of the flap to the defect For repair of defects about the nose, such flaps usually are elevated either adjacent to the defect or on the forehead and scalp

A tubed or "closed" flap of skin is prepared as a cylindrical structure with skin forming its outer surfaces, and fat its inner core The process of tubing a flap of skin eliminates external raw surfaces when the flap is transferred, thereby preventing infections and scar tissue in the flap, moreover, tubing a flap increases its blood supply

Before discussing the various types of simple and tubed pedicle flaps of skin which can be employed for the correction of defects about the nose, two factors should be considered

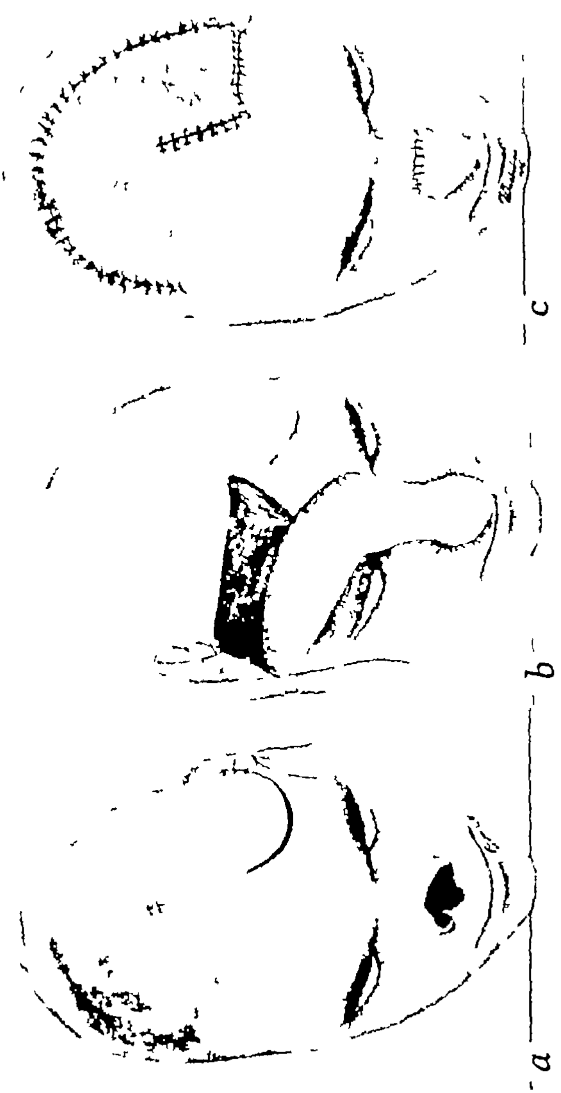


Fig. 4 (a) Midline sickle-shaped flap (b) When the blood supply is adequate the flap is brought down and folded to form nostrils and tip of the nose The denuded surface on the scalp and forehead is completely covered with a shaved skin graft as shown (c) Three weeks later the unused part of the pedicle flap is returned to the original donor site Only a small part of the skin graft is visible on the forehead after the hair has grown out

One is the need of an epithelial lining for many of these flaps When a pedicle flap is employed to cover a perforation or hole, that portion of the flap which covers the hole must be lined with skin, otherwise, the exposed raw surface of the flap covering the perforation will become excessively scarred, which causes distortion of the reconstructed part There are three methods of lining a pedicle flap of skin First, the distal end of the pedicle may be folded over on itself to form a lining Second, a small flap of skin adjacent to the defect, with a pedicle along the free margin of the defect, can be turned into the perforation with its raw surface up to form a lining This method cannot be used if the tissues adjacent to the defect have been irradiated or are badly scarred The third and usual method of lining a flap of skin involves the use of a free skin graft which is inserted under that portion of the flap which will be used for the reconstructive process Such a lining must be inserted under the flap at least two weeks before the flap is transferred

The other factor which should be considered is the necessity of elevating most flaps in stages Unless a flap is very short, with an extremely wide pedicle, it is likely to undergo sloughing if elevated and transferred in one operation This difficulty can be eliminated if the flap is elevated in degrees, suturing it back in its original bed after each operation By these surgical procedures, the vessels in the pedicle are stimulated to become larger until they are able to nourish the entire flap, which then can be transferred without danger of sloughing

Three types of pedicle flaps of skin may be employed in the repair of defects about the nose *1* contiguous flaps, *2* neighboring flaps and *3* distant flaps Contiguous pedicle grafts (see Figs 1 and 2) are simple open flaps which are elevated in tissues immediately adjacent to the defect and are advanced or rotated to cover the defect The contour and size of contiguous flaps vary according to the size, shape and location of the defect Consequently, it is useless to attempt to discuss all of them or to classify them

Neighboring flaps are pedicle grafts which are elevated in the same general anatomic region as the defect and are long

Before discussing the various types of simple and tube pedicle flaps of skin which can be employed for the correctio of defects about the nose, two factors should be considered

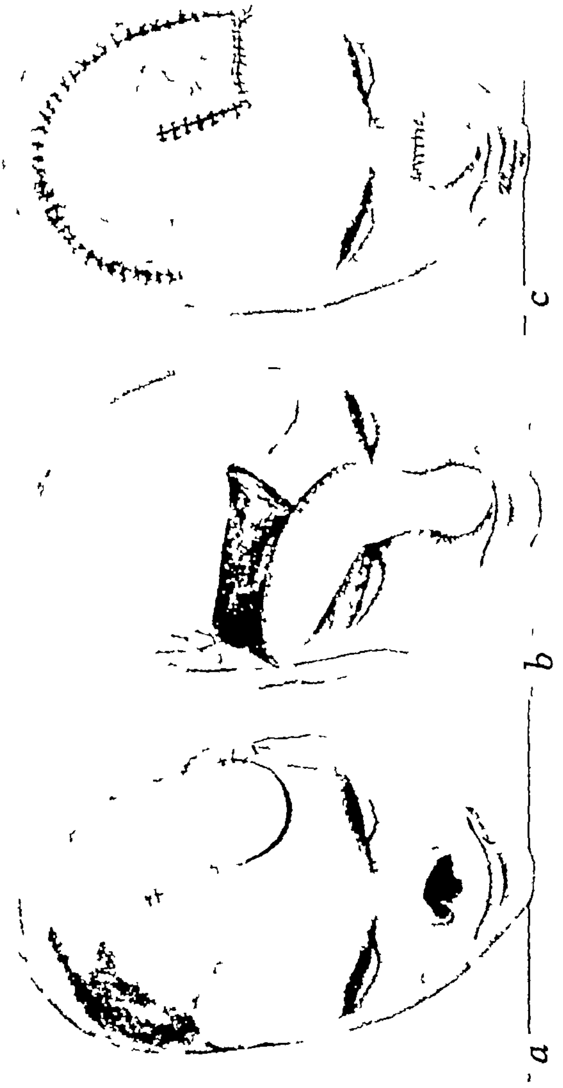


Fig. 1 (a) Midline sickle shaped flap (b) When the blood supply is adequate the flap is brought down and folded to form nostrils and tip of the nose The denuded surface on the scalp and forehead is completely covered with a shaven skin graft as shown (c) Three weeks later the unused part of the pedicle flap is returned to the original donor site Only a small part of the skin graft is visible on the forehead after the hair has grown out

One is the need of an epithelial lining for many of these flaps When a pedicle flap is employed to cover a perforation or hole, that portion of the flap which covers the hole must be lined with skin, otherwise, the exposed raw surface of the flap covering the perforation will become excessively scarred, which causes distortion of the reconstructed part There are three methods of lining a pedicle flap of skin First, the distal end of the pedicle may be folded over on itself to form a lining Second, a small flap of skin adjacent to the defect, with a pedicle along the free margin of the defect, can be turned into the perforation with its raw surface up to form a lining This method cannot be used if the tissues adjacent to the defect have been irradiated or are badly scarred The third and usual method of lining a flap of skin involves the use of a free skin graft which is inserted under that portion of the flap which will be used for the reconstructive process Such a lining must be inserted under the flap at least two weeks before the flap is transferred

The other factor which should be considered is the necessity of elevating most flaps in stages Unless a flap is very short, with an extremely wide pedicle, it is likely to undergo sloughing if elevated and transferred in one operation This difficulty can be eliminated if the flap is elevated in degrees, suturing it back in its original bed after each operation By these surgical procedures, the vessels in the pedicle are stimulated to become larger until they are able to nourish the entire flap, which then can be transferred without danger of sloughing

Three types of pedicle flaps of skin may be employed in the repair of defects about the nose *1* contiguous flaps, *2* neighboring flaps and *3* distant flaps Contiguous pedicle grafts (see Figs 1 and 2) are simple open flaps which are elevated in tissues immediately adjacent to the defect and are advanced or rotated to cover the defect The contour and size of contiguous flaps vary according to the size, shape and location of the defect Consequently, it is useless to attempt to discuss all of them or to classify them

Neighboring flaps are pedicle grafts which are elevated in the same general anatomic region as the defect and are long enough to permit direct transference to the defect To repair losses of tissue about the nose, neighboring flaps usually are elevated on the forehead and scalp My colleagues and I employ three different types of neighboring flaps which make use of the skin on the forehead *1* the loop-shaped supraorbital flap with a pedicle over one brow (see Fig 3), *2* the

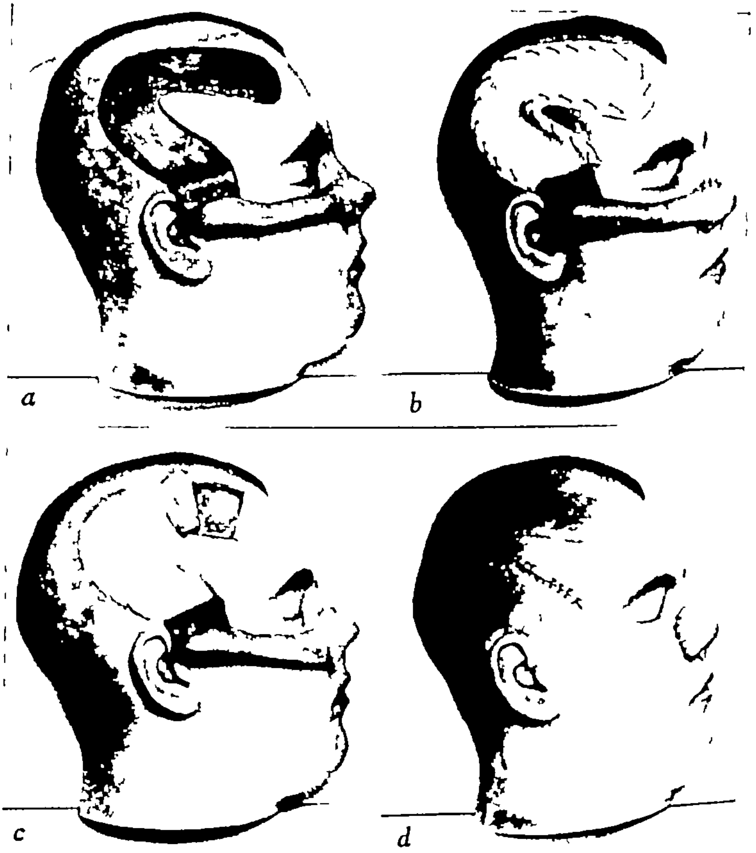


Fig 5 Sickle-shaped temporal flap (a) After elevating the flap in stages the edges of the nasal defect are freshened the flap is elevated and brought down so that its distal portion may be properly folded and sutured around the defect (b) The denuded surface on the scalp is covered with a shave skin graft The flap itself is wrapped in paraffin gauze to protect the eye from hairs which grow from the hair bearing part of the flap (c) Three weeks later the flap is severed from the reconstructed part and returned to the scalp A part of the shave skin graft is removed so that the unused part of the pedicle can be returned to its original bed on the scalp (d) The unused part of the flap has been returned to the scalp leaving only a small part of the shave skin graft visible on the forehead

midline sickle-shaped flap with a pedicle near the hairline (see Fig 4), and *3* the sickle-shaped temporal flap with a pedicle in the preauricular region (see Fig 5)

Distant pedicle flaps are elevated in some anatomic region other than that in which the defect is located A few of them will reach directly to the defect, but most of them can reach the recipient site only by migration or by the use of an intermediary, such as the wrist, which carries the flap to the defective part For defects about the nose, we generally employ four types of distant tube flaps elevated either on the neck or chest, they are *1* the cervical tube flap which is elevated usually along the course of the sternomastoid muscle (see Fig 6), *2* the clavicular tube flap which is elevated near the clavicle or directly across the clavicle (see Fig 7), *3* the chest tube flap which is elevated in a more or less vertical direction on the anterior chest wall (see Fig 8), and *4* the subaxillary tube flap which is elevated in a vertical direction on the side of the chest below the axilla (see Fig 9) Only in rare instances do we employ distant flaps of the simple open type, such as a flap on the arm or an open flap on the chest, which is attached to the wrist

As will be discussed, each group of flaps has certain advantages and disadvantages, and each flap in itself has one or more specific purposes No single one of the flaps described is capable of correcting every type of defect about the nose

For a small loss of tissue on the nose, contiguous flaps offer the quickest method of repair, moreover, their color and texture are the same as that of the rest of the face, since they are derived from the tissues adjacent to the defect Contiguous flaps, however, have a very limited degree of usefulness, since they can be employed only for small holes or perforations and can be elevated only in tissues which have not been irradiated and which are not excessively scarred

A small perforation on the nose can often be repaired quickly by means of a contiguous flap which acts as a lining and a full-thickness skin graft for a covering (see Fig 1)

A small semicircular flap is elevated adjacent to the perforation in one or two stages Eventually, it is turned with its raw surface up into the defect Subsequently, the mucous

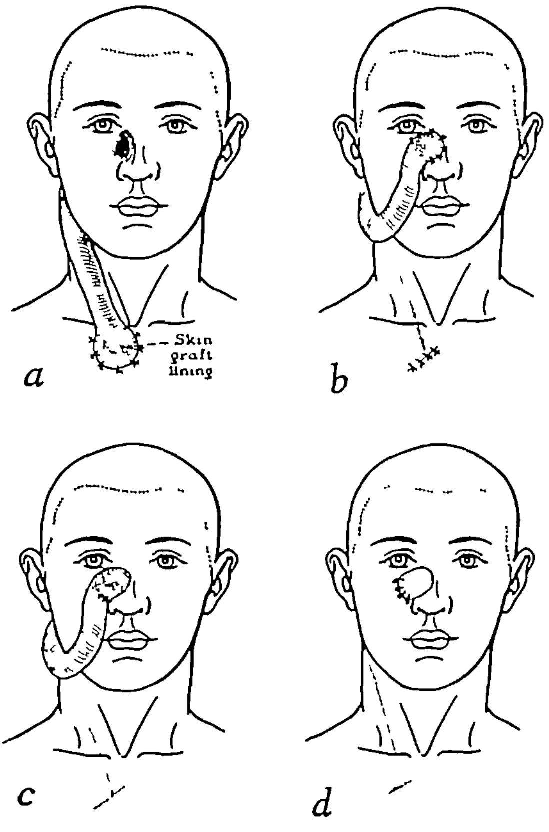


Fig 6 Cervical tube flap (a) The lower extremity of the tube flap which has previously been prepared is partially elevated and lined with a shave skin graft. The skin graft will form the lining for the reconstructed part (b) Ten days later the lower end of the cervical tube flap is elevated and attached to the margins of the defect on the right side of the nose (c) Two weeks later the tube is cut half-way across at the outer margin of the defect This incision is sutured (d) One week later the unused part of the tube is detached from the reconstructed part and also from the neck and discarded

membrane at the margins of the defect and the edge of the flap are sutured together A full-thickness skin graft behind one ear is dissected and inlaid into the defect to make an epithelial covering

If one wishes to avoid the use of an external full-thickness skin graft, the same type of perforation mentioned in the foregoing paragraph can sometimes be corrected by advancing a simple contiguous flap over the defect (see Fig 2) The flap, however, must be lined with a free skin graft

In general, my colleagues and I prefer to use a flap elevated on the forehead and scalp for the repair of all defects about the nose unless the forehead is scarred or unless the defect is small enough to be repaired by a contiguous flap Forehead flaps require less time in preparation, they are less likely to slough, they offer less difficulty in preparation and give better cosmetic results than do any of the tube flaps, however, forehead flaps do have the distinct disadvantage of producing more or less conspicuous scarring on the forehead This usually is of not great consequence in women, who can style their hair to cover the scarred area on the forehead, but in men it often is most undesirable As previously stated, forehad flaps cannot be used when the skin in this region is scarred and they are of no use in a defect which requires fat as well as skin for reconstruction

Generally we employ the sickle-shaped temporal flap for partial defects about the nose The loop-shaped supraorbital flap and the midline sickle-shaped flap are reserved mainly for total reconstruction of the nose or for repair of the nasal tip

The sickle-shaped temporal flap (see Fig 5) is the most useful of the forehead flaps for repair of partial defects of the nose This graft gives a very good cosmetic result and leaves less visible scarring on the forehead than is produced by any of the other forehead flaps This sickle-shaped temporal flap can be extended back into the scalp to give it any desired length, it makes use of the bay of skin on the side of the forehead, which is the most inconspicuous area on the forehead When this flap is transferred to a defect, and this applies to all of the forehead flaps, the denuded donor surface on the scalp and forehead is covered with a thin-shave skin graft Such a free graft protects the denuded surface, and

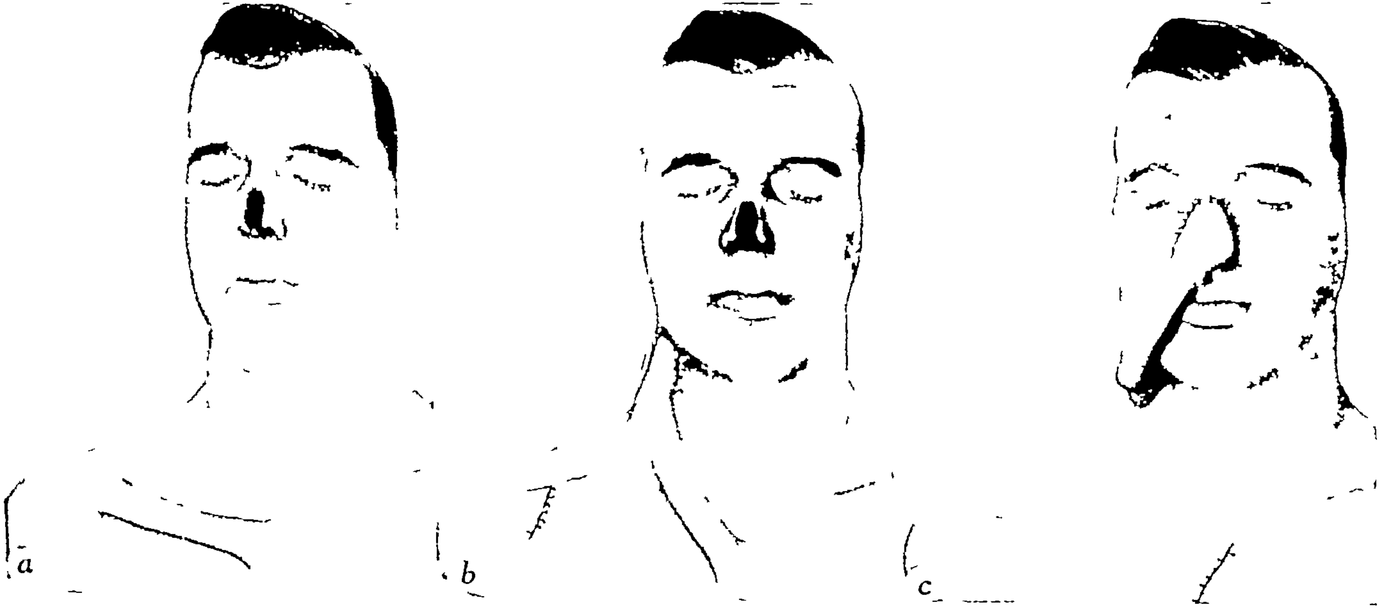


Fig. 7 Clavicular tube flap for partial nasal defects (a) A double pedicle flap of skin is elevated over or just below the clavicle and is tubed (b) Four to six weeks later the lateral end of the tubed flap is attached to the neck (c) Three weeks later the unused portion of the tube is cut off and discarded

prevents infection and the development of granulations and scar tissue Three weeks after the flap has been transferred, it can be cut across just above the reconstructed area and the unused part returned to the scalp Before the pedicle can be sutured back in the original donor site, the underlying free skin graft must be excised

Peculiarly enough, the donor area of a sickle-shaped temporal flap tends to shrink and contract, while the pedicle flap, after it has been transferred, tends to elongate Consequently, when the unused part is returned to the scalp, its length appears to be greater than it was originally As a result, only a very small amount of free-shave skin graft is left on the forehead

The loop-shaped supraorbital flap (see Fig 3) and the midline sickle-shaped flap (see Fig 4) are usually well adapted for total reconstruction of the nose or reconstruction of the nasal tip In both of these situations, the sickle-shaped temporal flap previously described is of no value It does not supply enough tissue for the reconstructive process and it does not have sufficient length to reach the defect without placing undue traction and torsion on the pedicle No flap is as satisfactory for total rhinoplasty as a forehead flap The color, texture and thickness of the skin in this region is perfectly adapted for reconstruction of an entire nose A forehead flap can be brought directly down to the nasal region and the distal extremity can be nicely folded to form a columella and nostrils Only when the forehead is scarred would we consider using a tube or arm flap for total rhinoplasty The color and texture of the skin in tube or arm flaps are poor, and the end of the flap, when transplanted to the nose, must be attached first over the bridge This circumstance necessitates the construction of the columella and nostrils after the unused part of the flap has been cut off and discarded It is rather difficult to fold properly the cut margin of the transplanted skin in an effort to make a columella and nostrils Although we believe that a chest or subaxillary tube flap will not produce a completely satisfactory result, a total nose constructed from an arm flap is even worse Consequently, we would never consider the use of an arm flap for total rhinoplasty unless the forehead and trunk were scarred sufficiently to prohibit the elevation of a flap in one of these regions

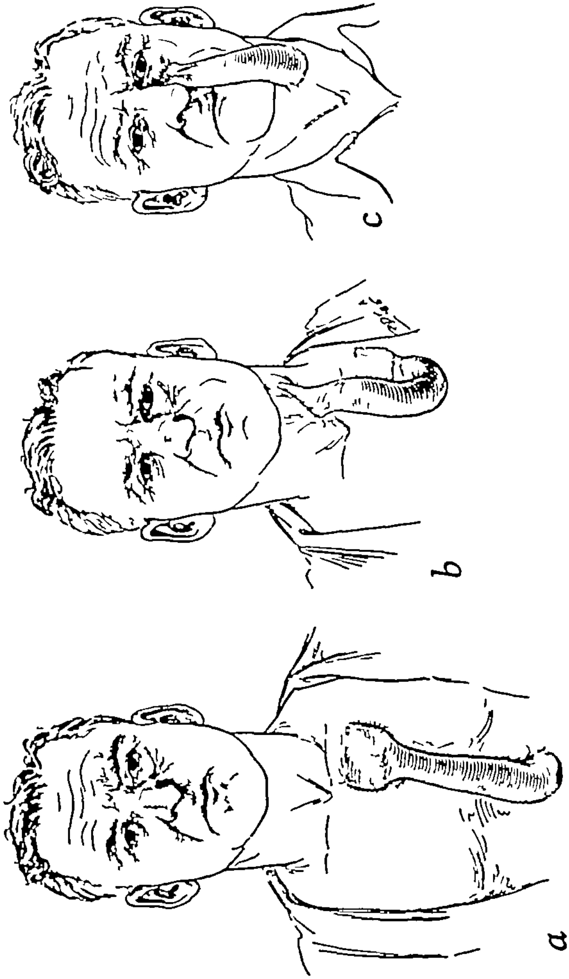


FIG 8 Use of the upper end of a thoracic tube flap for nasal reconstruction because of the more satisfactory color (a) The upper end of the tube flap is lined with a full thickness or shave skin graft This is indicated by the dotted area (b) Later the lower end is detached from the chest and sutured to the midcervical region (c) When this has healed in three or four weeks the upper end of the tube is cut across and elevated to the nasal defect

For total rhinoplasty, a loop-shaped supraorbital flap (see Fig 3) is the one that we usually employ, however, for any patient who has a very high forehead, a midline sickle-shaped flap (see Fig 4) will construct a good nose with less noticeable scarring on the forehead, the scarring, when this flap is used, is situated farther away from the eyebrow and consequently is less conspicuous

It is well to remember that the average forehead is not sufficiently high to warrant the use of a midline sickle-shaped flap, which of necessity must be made longer than the more commonly used loop-shaped supraorbital flap As a matter of fact, the forehead usually will afford no more than just enough tissue to construct a whole nose without including hair-bearing skin

When merely the lower third or tip of the nose is lost, the midline sickle-shaped flap (see Fig 4) is ideal because only a small amount of skin free of hair is necessary to reconstruct the lost portion of the nose Under such circumstances, the midline sickle-shaped flap is to be recommended, since it will leave less visible scarring on the forehead than would a loop-shaped supraorbital flap

These two types of forehead flaps require considerable time in preparation (see Fig 3) and several stages in elevation in order to insure an adequate blood supply The edge of the distal portion of the flap always is folded to form a columella and nostrils By this process the lower half of the newly constructed nose is lined with skin Whether or not the upper half needs to be lined with a free skin graft depends on the size of the nasal defect If so, this free skin graft should be applied to the undersurface of the flap in the first stage of its elevation.

A reconstructed nose or nasal tip should be made somewhat larger than necessary to allow for subsequent shrinkage Three to six months after the nasal reconstruction has been completed the excess fat should be excised to effect a better contour This can be accomplished by incising and undermining the skin over the dorsum of the reconstructed nose to permit removal of the excess fat over the top and sides Later, excess fat around the nostrils can be removed through incisions along the lower border of the nostrils nose constructed from an arm flap is even worse Consequently, we would never consider the use of an arm flap for total rhinoplasty unless the forehead and trunk were scarred sufficiently to prohibit the elevation of a flap in one of these regions

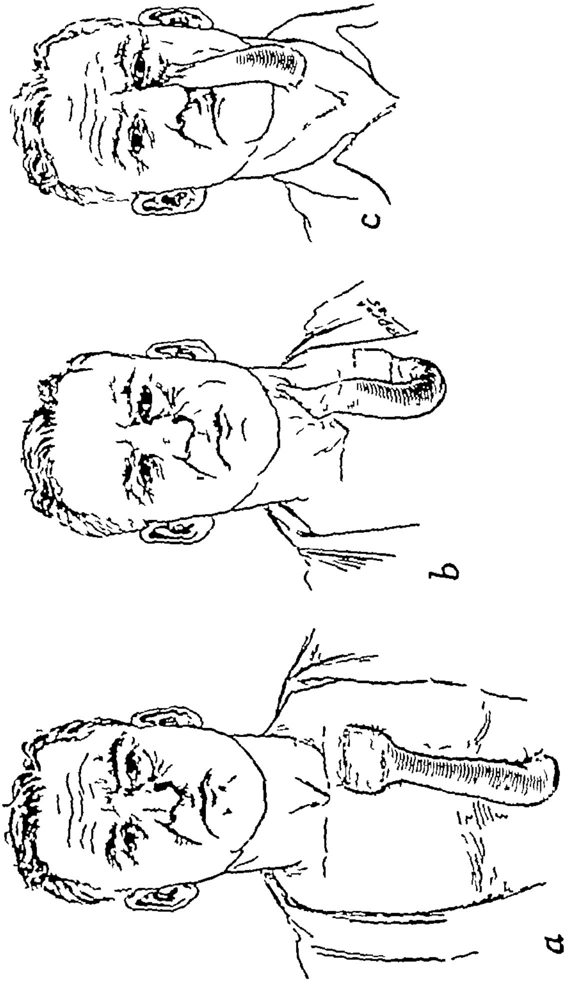


Fig 8 Use of the upper end of a thoracic tube flap for nasal reconstruction because of the more satisfactory color (a) The upper end of the tube flap is lined with a full thickness or shaved skin graft This is indicated by the dotted area (b) Later the lower end is detached from the chest and sutured to the midcervical region (c) When this has healed in three or four weeks the upper end of the tube is cut across and elevated to the nasal defect

For total rhinoplasty, a loop-shaped supraorbital flap (see Fig 3) is the one that we usually employ, however, for any patient who has a very high forehead, a midline sickle-shaped flap (see Fig 4) will construct a good nose with less notice-

[illegible]

[illegible]

[illegible]

[illegible]

a [illegible] larger than necessary [illegible] six months after the initial reconstruction [illegible] excess fat should be excised [illegible]. This can be accomplished by [illegible] along the skin over the [illegible] of the [illegible] removal of the excess fat over the [illegible] ter, excess fat around the nostrils can be [illegible] cisions along the lower border of the nasal [illegible]

When the forehead or scalp is scarred, thus prohibiting the use of a forehead flap, tube pedicle flaps of skin elevated on the neck and trunk are by necessity required for the repair of many nasal defects The one great advantage in a tube flap on the neck or chest or trunk lies in the fact that scarring at the donor site is not visible when the patient is clothed Under ordinary circumstances, only one end of a tube flap is employed for reconstruction

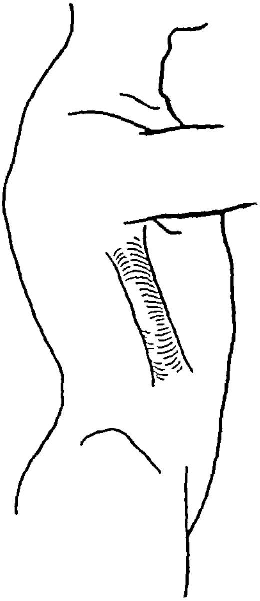


Fig 9 Subaxillary tube flap This is elevated in a vertical direction below the axilla and along the course of the thoracoepigastric veins

Cervical and clavicular tube flaps (see Figs 6 and 7) can be considered together because they are employed for the same purpose They supply tissue for smaller defects about the nose A cervical flap has the advantage of reaching directly to the defect, but has the disadvantage of leaving visible scarring on the side of the neck when the patient is clothed On the other hand, a clavicular tube flap is too short to reach directly to the defect, one end must be attached to the side of the neck as an intermediary stage before the other end can be detached and transferred for the reconstructive proc ess In consequence, a clavicular tube flap requires an extra four weeks' time in preparation It has the advantage, however, of leaving no visible scarring when the patient is clothed, as does the cervical tube flap

Chest tube flaps and subaxillary tube flaps (see Figs 8 and 9) are used essentially for the same purposes Each supplies a large amount of tissue, both fat and skin A chest tube flap usually is employed in men If possible, we prefer to use the upper end as it has a better color for nasal reconstruction, however, this necessitates bringing up the lower end of the chest tube and attaching it to the side of the neck, after four weeks the upper end may then be detached and used for repair of the nasal defect A subaxillary tube rather than a chest tube is usually employed in women A chest tube flap not only is difficult to elevate in women because of the breasts, but after elevation it produces considerable distortion of the breasts In both men and women, the one great disadvantage of employing a subaxillary tube flap for defects about the nose is that it must be made very long and requires many stages in its elevation and transference to the nose To shorten this period, one end of the tube can often be attached to the wrist, which acts as an intermediary to bring the tube directly to the nose, however, this technique usually is not advisable when the flap requires a lining, because this process necessitates too long a period of immobilization of the arm

As previously discussed, the only instance in which we would employ an arm flap for repair of defects about the nose is in patients with scarring on the forehead, neck and trunk, a complication that prohibits the use of any forehead or tube flap Arm flaps are composed of skin which lacks body and which is more likely to slough than the dermal tissue in any of the other pedicle grafts

When the forehead or scalp is scarred, thus prohibiting the use of a forehead flap, tube pedicle flaps of skin elevated on the neck and trunk are by necessity required for the repair of many nasal defects The one great advantage in a tube flap on the neck or chest or trunk lies in the fact that scarring at the donor site is not visible when the patient is clothed Under ordinary circumstances, only one end of a tube flap is employed for reconstruction

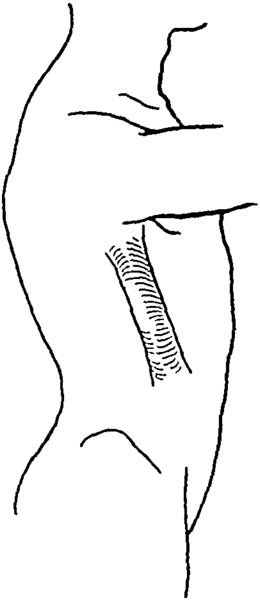


Fig 9 Subaxillary tube flap This is elevated in a vertical direction below the axilla and along the course of the thoracoepigastric veins

Cervical and clavicular tube flaps (see Figs 6 and 7) can be considered together because they are employed for the same purpose They supply tissue for smaller defects about the nose A cervical flap has the advantage of reaching directly to the defect, but has the disadvantage of leaving visible scarring on the side of the neck when the patient is clothed On the other hand, a clavicular tube flap is too short to reach directly to the defect, one end must be attached to the side of the neck as an intermediary stage before the other end can be detached and transferred for the reconstructive proc ingering a dropped tip, retracted columnella, or saddling advocated, in principle, making an incision over the caudal of the septum and elevating the mucous membrane on the osite side He then incised through just the cartilage posiorly, freeing the caudal end from the soft tissues of the umnella An incision was also made through the cartilage at base The only remaining attachment was above Crosstching of the deformed cartilage was sometimes necessary llowing this, the cartilage was placed in a groove made in e vomer and sutured in place into a new pocket in the colnnella This operation often failed in our hands as the cartilage frequently returned to the previous position, however, in ome instances a satisfactory result was obtained

The principle of removing the cartilage of the septum and eplacing it between the mucous membrane is not new The artilage of the septum is nourished by imbibition of lymph and consequently it was thought that it was reasonable to expect that cartilage could be removed and replaced and still remain viable or at least remain long enough to prevent retraction

The object of this paper is to evaluate fairly recent methods of correcting deformities of the cartilaginous part of the septum. These operations attempted to overcome the faults of the Killian operation They have been described by Fomon and others During the last seven years we have done over 200 operations involving the techniques described and have used both autogenous and homologous cartilage

Analgesia consists of 1½ gr of nembutal, 1/6 gr of morphine sulphate and 1/150 gr of atropine sulphate, 45 minutes previous to the operation A solution of equal parts of 10 per cent cocaine and 1-1000 adrenalin is used for the block anesthesia, cotton-tipped applicators are placed in the region of the sphenopalatine ganglion, the internal nasal nerves and the foramen for the anterior palatine nerve Following this, the soft tissues [illegible] nella and the septum are injected with a [illegible] cent monocaine with epinephrine

RECONSTRUCTION OF THE NASAL SEPTUM[*]

D M Lierle, M D , and W C Huffman, M D ,[†]
Iowa City, Iowa

The orthodox Killian submucous operation is fairly satisfactory for the deformities of the posterior or bony compartment of the nose but it is not adequate for dislocations and deformities of the anterior or cartilaginous compartment of the septum Some of the objections are *1* It is not always adaptable in children *2* The removal of the most ventral portion of the cartilaginous part of the septum with high deflection and most caudal portion with anterior dislocation is not attempted because of the danger of resulting contraction causing saddling of the dorsum of the nose and distortion of the tip, consequently, these deformities are not corrected and the function is not restored as far as the pathways of the normal air currents are concerned *3* The removal of most of the cartilaginous and bony frame work of the septum often results in flaccidity and thickening of the soft tissues The membrane is unable to resist intranasal pressures, and as a result there is distortion of the normal pathways of air currents *4* In a case of a twisted nose with deformity of the vertical buttress, failure to remove the buttress allows the obstruction to persist *5* There may be lacerations of the membrane with resulting perforations

Metzenbaum made an attempt to overcome at least one of these objections, he attempted to replace the dislocated cartilage in the midline — thus relieving the obstruction without

---

[*] Read at the Fifty-third Annual Meeting of the American Laryngological Rhinological and Otological Society Inc. Chicago Ill April 18 1949

[†] From the Department of Otolaryngology and Oral Surgery State University of Iowa Iowa City Iowa.

Editor s Note This ms received in Laryngoscope Office and accepted for publication July 2 1949

endangering a dropped tip, retracted columnella, or saddling He advocated, in principle, making an incision over the caudal end of the septum and elevating the mucous membrane on the opposite side He then incised through just the cartilage posteriorly, freeing the caudal end from the soft tissues of the columnella An incision was also made through the cartilage at the base The only remaining attachment was above Cross-hatching of the deformed cartilage was sometimes necessary Following this, the cartilage was placed in a groove made in the vomer and sutured in place into a new pocket in the columnella This operation often failed in our hands as the cartilage frequently returned to the previous position, however, in some instances a satisfactory result was obtained

The principle of removing the cartilage of the septum and replacing it between the mucous membrane is not new The cartilage of the septum is nourished by imbibition of lymph and consequently it was thought that it was reasonable to expect that cartilage could be removed and replaced and still remain viable or at least remain long enough to prevent retraction

The object of this paper is to evaluate fairly recent methods of correcting deformities of the cartilaginous part of the septum These operations attempted to overcome the faults of the Killian operation They have been described by Fomon and others During the last seven years we have done over 200 operations involving the techniques described and have used both autogenous and homologous cartilage

Analgesia consists of 1½ gr of nembutal, 1/6 gr of morphine sulphate and 1/150 gr of atropine sulphate, 45 minutes previous to the operation A solution of equal parts of 10 per cent cocaine and 1-1000 adrenalin is used for the block anesthesia, cotton-tipped applicators are placed in the region of the sphenopalatine ganglion, the internal nasal nerves and the foramen for the anterior palatine nerve Following this, the soft tissues of the columnella and the septum are injected with a solution of 1 5 per cent monocaine with epinephrine

(1-30,000) In the event it is necessary to uncover the soft tissues of the nasal pyramid, additional analgesia is obtained by blocking with monocaine intranasally the infratrochlear, external nasal and infraorbital nerves

The first operation was known as the "Galloway procedure" and briefly consists of *1* removal of the deformed septal cartilage, trimming it so that it is straight, replacing it between the septal flaps, making a new columnellar bed, removing the nasal spine when necessary, drawing the cartilage down into this bed, and suturing it into place, *2* the correction of the bony deformities involving the posterior or cephalic compartments The technique of the Galloway operation is as follows

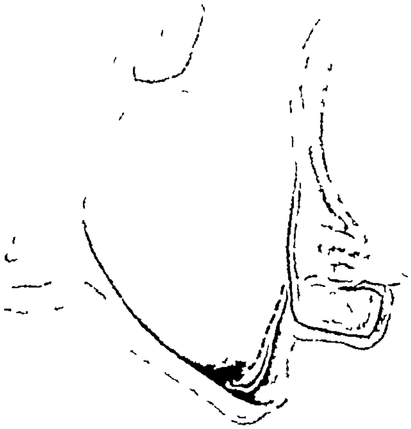


Fig 1

An incision is made along the projecting edge of the septal cartilage from front to back If the mucoperichondrium is incised down to the cartilage throughout the length of the incision, all succeeding steps will be greatly facilitated (see Fig 1)

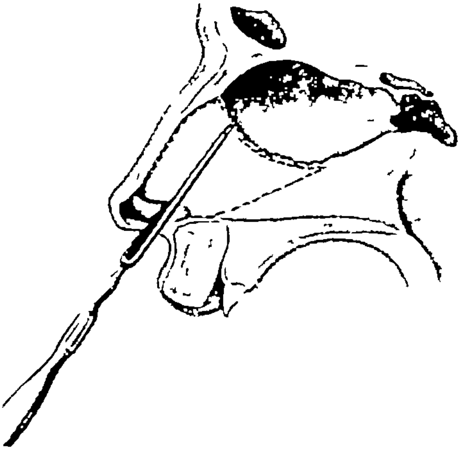


Fig 2

The operator now proceeds to elevate the mucoperichondrial flaps from both sides of the septum by any method to which he is accustomed The extent of the elevation of the flaps on each side of the septum will naturally depend upon how much of the septum is to be removed If a complete submucous resection is to be done — that is if there is obstruction in the posterior as well as in the anterior compartment of the nose— the entire skeleton of the septum is bared as in the usual operation

If all of the cartilage has been removed then the size and shape of the cartilaginous graft to be replaced is determined by measuring the distance from the lower edge of the nasal bones to the tip of the nose and from the nasal tip to the septolabial angle (see Fig 3) In the majority of cases some cartilage can be left along the dorsum so that only the measurements from the tip of the nose to the septolabial angle is of consequence If necessary the nasal spine is removed at this time

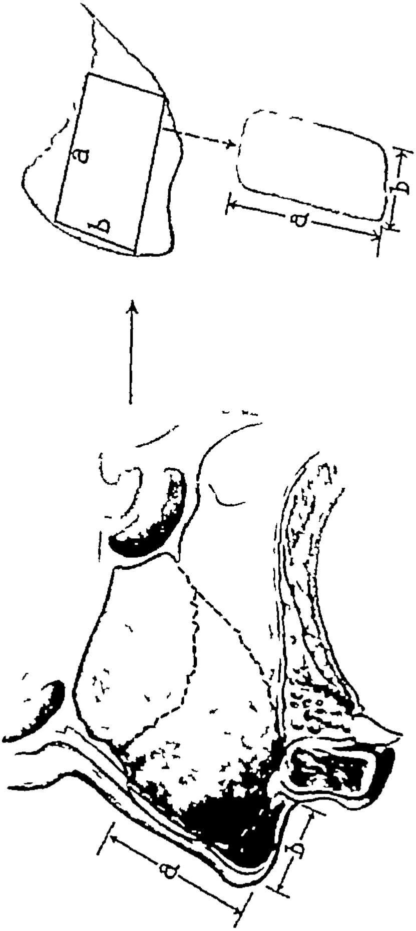


Fig 3

The removed septal cartilage is examined to find an area that is firm and straight (If the septal cartilage that is removed is so fragmented or deformed and it is impossible to procure from it a graft of the correct size, it is permissible to use septal cartilage that has been removed from another nose and preserved in merthiolate.) The measurements are laid out on any portion of the cartilage that meets requirements and the rectangular graft is excised.

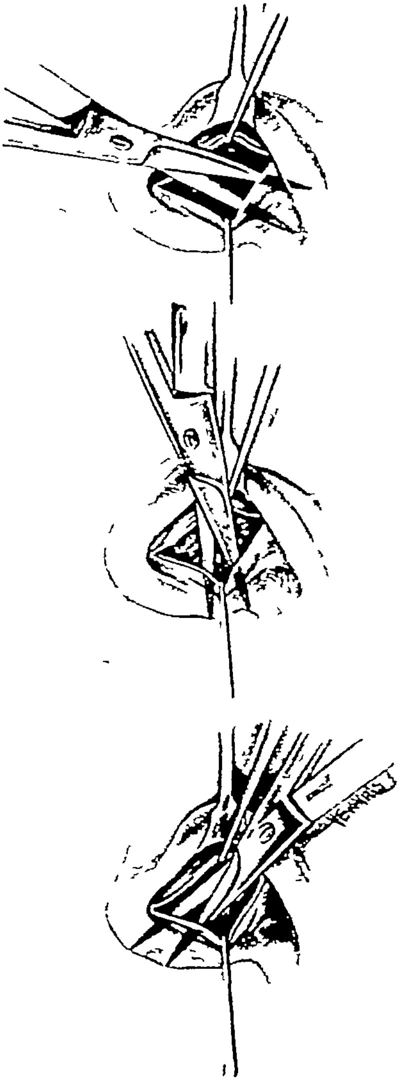


Fig 4

After excision of the graft, it is laid aside and a bed is made in the columnella to receive it Either a scalpel or a pair of small scissors is introduced into the columnella by way of the original incision through the mucoperichondrium and a deep bed is dissected from the nasal tip to the nasal spine (see

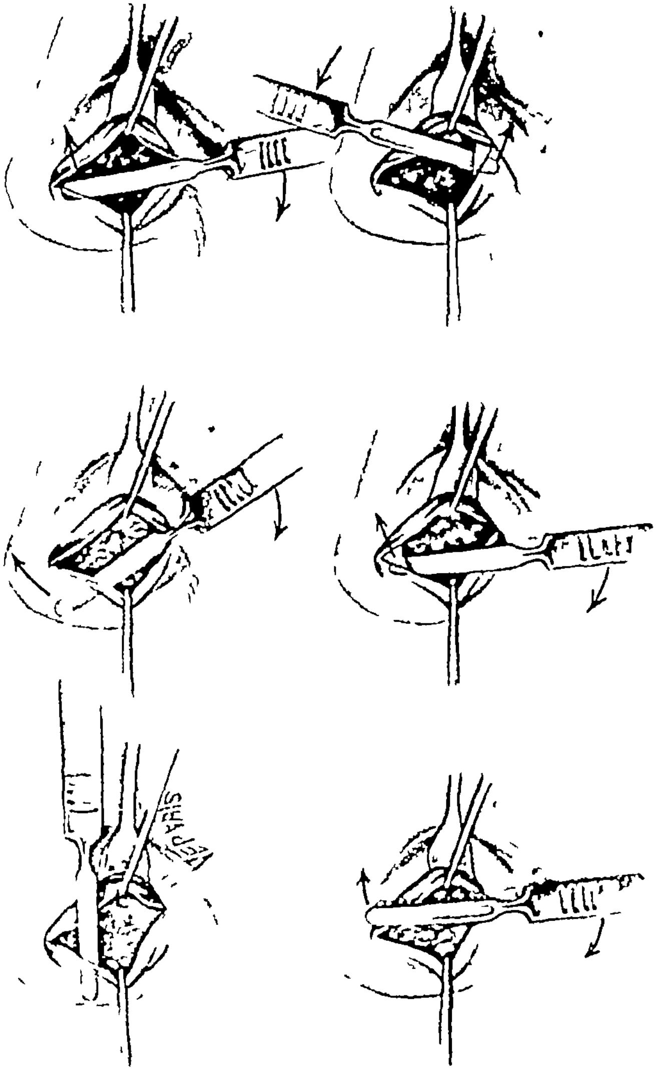


Fig 5

Fig 4) Any fibrous strands connecting the two edges of the incision (preventing insertion of the graft) can be found by exploration with an elevator and then cut under direct vision (see Fig 5) so that the incision opens into the columnellar bed along its entire length

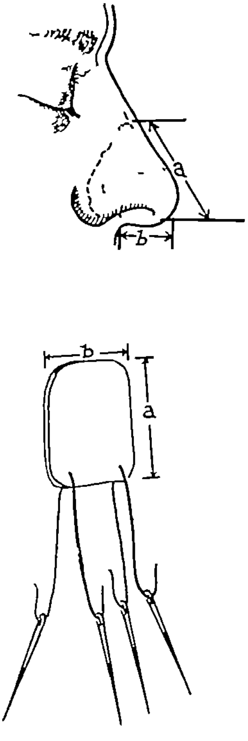


Fig 6

In order to facilitate handling of the graft, two double-armed silk sutures are passed through the end of the graft that is to fit into the columnella (see Fig 6) The cartilage is grasped with a pair of forceps and inserted between the septal flaps

After the cartilage is between the flaps, the double-armed silk sutures are passed through the original incision into the columnellar bed and are pushed through the columnella, being brought out on its under surface (see Figs 7 and 8) The two sutures are used to draw the graft down into its bed in the columnella and to hold it in place while fixation sutures are being passed (see Fig 9)

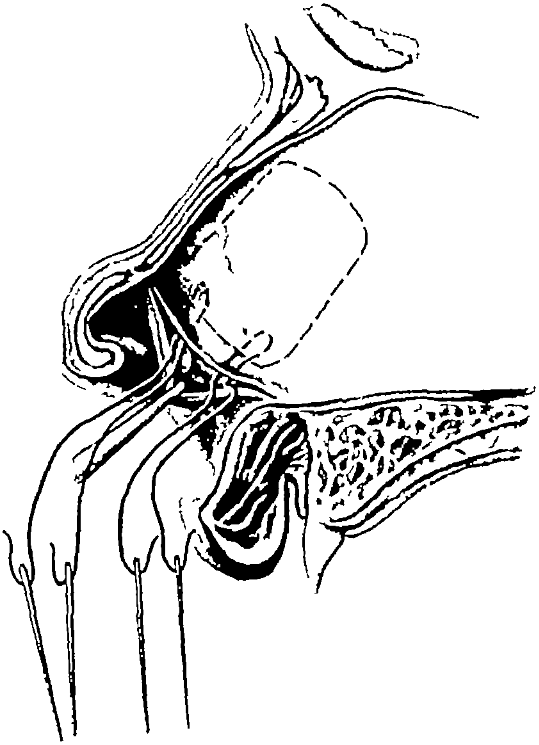


Fig 7

While the graft is held firmly in the columnellar bed by means of the temporary sutures previously passed through the graft and out through the columnella, the final sutures are passed (see Fig 10)—one posteriorly and one anteriorly Each suture is started above the incision and passed through the septal flap, through the graft, through the opposite septal flap, and then is brought back through the columnella below the incision

The temporary sutures are removed and the septal flaps are firmly packed against the cartilage graft with vaseline gauze Unless there are signs of interference with drainage, these packs are left in place three or four days The two silk sutures are removed on the seventh or eighth postoperative day

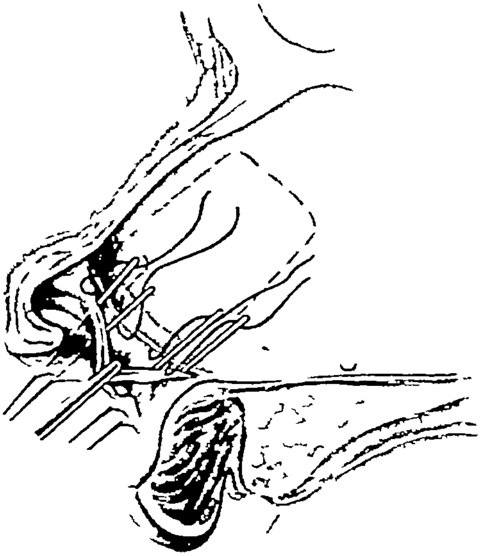


Fig 8

As a matter of routine, the patient is kept on full doses of penicillin for seven postoperative days

The technique of the second or Fomon operation is briefly as follows *1* The membranous septum on the right side of the septum is incised throughout its length by a Bard Parker Knife, No 15, and a new bed is created by separating the laminae of the columnella with a Bard Parker knife and Stevens scissors, a batten of cartilage (2 to 5 mm in width and 2 5 to 3 cm in length) is inserted between the flaps of the columnella and fixed in place by two through and through silk mattress sutures behind the cartilage This cartilage is not intended to act as support, but mainly adds stiffening to the columnella and keeps it from retracting *2* A transfixion is done by cutting the opposite membrane with a knife, and the remaining membranous septum is cut by straddling and holding the scissors perpendicular to the nasal spine 3 The caudal end of the septum is trimmed with a knife, the soft

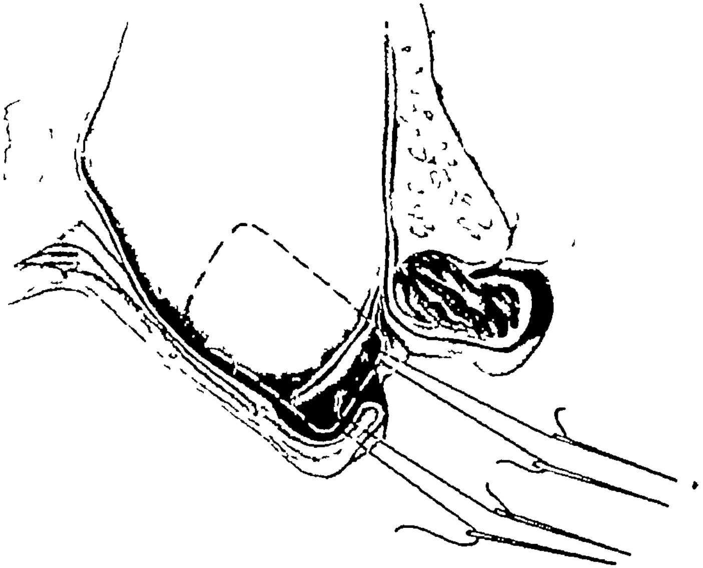


Fig 9

tissues elevated on both sides for a short distance, and a curved needle with heavy silk is passed through the caudal end of the membrane on either side above and below The suture ends are grasped with a hemostat and thrown over the side of the face to act as retractors 4 The membrane is elevated over the cartilage and bone in the usual manner, and the obstructing cartilage is resected with scissors and/or a swivel knife as far ventrically, cephalically and dorsally as is necessary, again leaving some of the cartilage along the dorsum At this time deviations of the vertical plate may be corrected and spurs of the vomer may be removed along with the nasal spine when necessary The deformed cartilage is trimmed so that it is straight, is reinserted between the flaps and held in place by through and through silk mattress sutures If it is necessary to use a number of smaller pieces of cartilage (see Fig

10), the nose is first packed on both sides with vaseline gauze and the pieces of cartilage are held in place by the pack The cartilage of the patient should be made usable by trimming, shaving or cross-hatching if possible If not, cartilage preserved in merthiolate is used 5 The nasal fossae are firmly packed with vaseline gauze to apply moderate pressure on the membrane to the cartilage grafts and to prevent the formation of hematomas The packs are removed on the fourth day and the sutures from the fifth to the seventh day

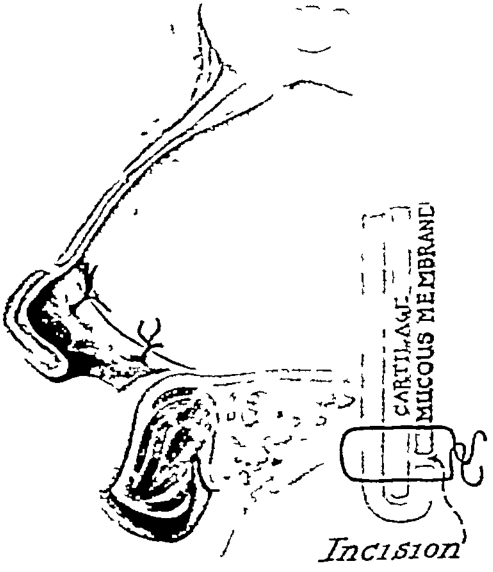


Fig 10

Frequently obstructing septums are associated with external nasal deformities These external deformities should be corrected not only for aesthetic reasons but also to improve the function of the nose It is quite obvious that a thickened columnella, an old fracture or a recessed tip due to a short columnella, etc, may interfere with the intake of air and cause abnormal deviation of air currents

Most authorities feel that when septal and external deformities are both present it is preferable to do the septal surgery first and to correct the external deformities later Although in general this is a safer procedure, we have done both procedures at the same time and have had no complications, however, if this is done, there should be a definite order of procedure *1* The soft tissues over the nasal pyramid are elevated *2* The profile projection is reduced *3* The batten is placed in the columnella *4* Following completion of the transfixion, the septal cartilage is removed and the obstruction of the septum corrected *5* The upper lateral cartilages are cut from the septum and trimmed when necessary This step is done following the resection of the septum because the attachment of the upper laterals to the septum furnishes stability — thus making the resection easier *6* The osteotomy *is done and the nose is narrowed* *7* *The lower* lateral cartilages are freed and delivered and trimmed if necessary *8* Finally, the battens of cartilage are placed between the septal flaps *9* The nose is packed

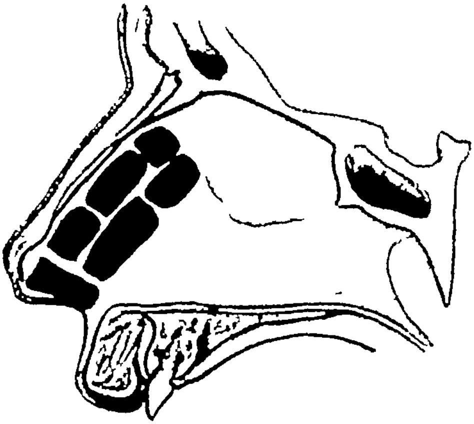


Fig 11

DISCUSSION

The statement has been made that the septum under static conditions does not furnish support to the nasal pyramid but merely acts as a reserve safety factor It is claimed that the entire quadrilateral cartilage can be removed without danger of collapse of the nasal pyramid at the time of operation Generally speaking, this may be true, but we have seen a number of cases of saddling immediately following the removal of the entire cartilaginous septum There is a weak point of the dorsum caudal to the attachment of the upper lateral cartilages to the nasal bones This area varies in extent due to the fact that at times the upper lateral cartilages swing away from the septum at an unusually high level cephalically Saddling may occur here at the time of removal of the cartilage in the region of the lower lateral cartilages when the cartilages are under developed or soft in texture In most instances some of the cartilage along the dorsum may be left, but if it is necessary to remove all of the cartilages in a twisted nose — then the operator must have enough experience in rhinoplastic surgery to repair the saddling defect

One of the chief objections to the Galloway operation is that replacement of the cartilage as a single plate, which is drawn into a deep columnellar pocket, leaves the columnella and membranous septum more or less immobile In a few cases the immobility will lend a certain "frozen" or stiff appearance to the nasal lobule This may be obviated to a certain degree by making the pocket more cephalically and not drawing the septal cartilage so deeply into the columnella The Fomon operation eliminates this complication by utilization of the cartilage as several grafts — one narrow strip in the columnella and several small plates between the septal flaps

In a comparatively small percentage of cases when one plate of cartilage is used and only one unilateral incision is made, there may be buckling or drawing of the cartilage to one side, causing varying degrees of obstruction This is thought to be due to unequal scar contraction because of the unilateral incision and to the lines of contracture during the healing converging toward the center of the single graft The second, or Fomon, operation eliminates this complication by virtue of the transfixion, in addition the lines of contraction between the healing septal flaps are broken because of the multiple battens of cartilage

There has been absorption of cartilage in a few cases—particularly when homologous cartilage was used, however, such cartilage has remained *in situ* long enough in every instance except one to prevent contractions of the tip and saddling of the dorsum

The Fomon operation has proved to be more satisfactory in the majority of cases because it overcomes the complications of the frozen, stiff nose and eliminates buckling or bowing of the cartilage

Most of us in the past have had failures in improving breathing with the orthodox submucous operation We have corrected fairly satisfactorily deformities of the vertical plate and vomer, but we have neglected to open the front door of the nose It is quite obvious that to improve nasal function deformities of the anterior cartilage and certain external deformities must be corrected It is our opinion that the principles of these operations are correct but much remains to be done in perfecting them The entire septum should be removed only in those cases where there is definite deformity of the dorsum of the septal cartilage, such as in the twisted nose This operation implies that the operator must have a thorough knowledge of rhinoplastic procedures and be able to cope with any situation which may present itself If there are no complications other than the simple dislocation of the anterior cartilage, then the average rhinologist with some training could and should be able to correct the deformity

BIBLIOGRAPHY

1 FOMON, SAMUEL, and Associates Plastic Repair of the Obstructing Nasal Septum *Arch Otolaryngol*, 47 721 Jan 1948

2 METZENBAUM, MYRON Asymmetry of the Nares *Arch Otolaryngol* 16 690 697, Nov , 1932

3 METZENBAUM MYRON Dislocation of the Lower End of the Nasal Septal Cartilages *Arch Otolaryngol*, 24 78 88 July, 1936

THE USE OF THE MAGNET IN THE TRACHEOBRONCHIAL TREE, THE ESOPHAGUS, STOMACH AND DUODENUM[*][†]

MURDOCK EQUEN, M.D., GEORGE ROACH, M.D. (by invitation),
AND ROBERT BROWN, M.D. (by invitation),
Atlanta, Ga.

Electromagnets have long been used in the extraction of metallic bodies from the eye. Shortly after World War I, Jackson, Tucker and Clerf used such a magnet to dislodge a bullet from the upper lobe of a veteran's lung and bring it down to a main bronchus from which they removed it with forceps. Electromagnets, however, have seldom proven useful in endoscopic work.

In 1943, the General Electric Company perfected a permanent magnet for practical use in endoscopy. A cylinder of fused aluminum, cobalt and nickel, small enough to be passed through a bronchoscope, it needed no batteries or wiring. In 1944, the senior author reported its use in the removal of an open safety pin from the esophagus, before the Southern Medical Association. It is our purpose here to review the application of this magnet.

In cases of doubt as to whether the foreign body will respond to the magnet, one may employ an adaptation of the "mine detector" so extensively used in the recent war. The Berman locator (manufactured by the Waugh Laboratories, a subsidiary of the General Electric Company) will settle the doubt in a few minutes.

---

[*] Read at the Fifty-third Annual Meeting of the American Laryngological Rhinological and Otological Society Inc. Chicago Ill. April 19 1949

[†] From the Ponce de Leon Ear Nose and Throat Infirmary

Editor's Note This ms received in Laryngoscope Office and accepted for publication, May 2 1949

Fig 1 (A) The bobby pin in the infant's trachea and right bronchus (Case 1)

TRACHEOBRONCHIAL TREE

Of course, many metallic foreign bodies can still be removed with forceps from the trachea or larger bronchi Sometimes, however, an ordinary straight pin will drop down the tracheobronchial tree almost to the diaphragm When the pin (or any other object) becomes lodged in a bronchiole it is most difficult to grasp it with forceps Passing a small bronchoscope as near it as possible under the guidance of a biplane fluoroscope enables one to push a small magnet near enough

Fig 1 (B) Its magnetic withdrawal (Case 1)

to attract the pin Such a case was reported before this Society three years ago The patient went home well two days later

Even when the foreign body can be picked up with forceps, however, it is simpler merely to insert a laryngoscope, lifting up the epiglottis, and to push the magnet fused onto a ureteral catheter into the trachea This involves no trauma to the trachea Occasionally, it is true, the vocal cords will strip the foreign body from the magnet and then it can be quickly picked up with forceps [illegible] was playing with his [illegible] The baby placed it in his [illegible] caused his mother to turn [illegible] appeared all right He was [illegible] This revealed the [illegible] into the right main stem [illegible] a large object, the [illegible] chest it appeared enor[illegible] pin was removed with [illegible] went home well without [illegible]

[illegible] the magnet (and the [illegible] must be used) does [illegible] on the part of a [illegible] and of his assistants, in[illegible] nor does it obvi[illegible] instruments of vary[illegible]

[illegible]

[illegible] through the gastrointes[illegible] is an exception to the [illegible]

[illegible] a large Italian coin [illegible] home as a souvenir of [illegible] unintentionally swal[illegible] and could swallow [illegible] was brought to the [illegible] coin caught in the [illegible] the Berman locator [illegible] Mussolini did not use [illegible] in 1944 our own [illegible] anesthetized, and [illegible] Contact was estab[illegible] that it did not [illegible] the coin had been [illegible]

[illegible] propensity of putting into their mouths everything they can get hold of, because they are brought up on [illegible] because their mothers forget the importance of [illegible] open safety pins within a baby's reach, one of the most common foreign bodies found in a baby's esophagus is an open safety pin, with the point up When an open safety pin is found in the esophagus, the surgeon has few choices *1* it may be possible to close the pin *in situ*, and then to remove it, but at best this causes considerable trauma to the organ, *2* the pin may be cut in two and removed piecemeal, but this is a traumatic business, *3* the pin may be grasped by the spring with a forceps and

Fig 2 (B) The pin is being withdrawn point up nonmagnetic head trailing (Case 3)

pushed down into the stomach Once in the stomach, sometimes the surgeon can reverse it and withdraw it, the point trailing, more often, however, he will lose his hold on the pin and he will have to call on a general surgeon to remove it through an abdominal incision, a formidable procedure in a baby

Case 1 Gerald, aged seven and one-half months, was playing with his mother's purse when a bobby pin slipped out. The baby placed it in his mouth and, in swallowing it, made a noise that caused his mother to turn around He vomited a few times but then appeared all right He was taken to his family physician, who secured an X ray This revealed the bobby pin in the lower trachea, extending down into the right main stem bronchus Though the bobby pin is not considered a large object the plate (see Fig 1, A) shows that in this infant's chest it appeared enormous Within an hour of its aspiration, the bobby pin was removed with a small lung magnet Three days later, Gerald went home well without even having had an elevation of temperature

It may be remarked that the use of the magnet (and the model best suited to the individual case must be used) does not render less necessary experienced skill on the part of a surgeon specializing in endoscopy, and of his assistants, including the anesthetist and Roentgenologist, nor does it obviate the need for a full armamentarium of instruments of varying sizes

THE ESOPHAGUS

Swallowed coins will usually pass through the gastrointestinal tract uneventfully This case is an exception to the general rule

Case 2 Jean, aged seven years, was playing with a large Italian coin the size of a half dollar, her father had brought home as a souvenir of his fighting overseas She put it in her mouth and unintentionally swallowed it After that she suffered constant distress and could swallow only liquids Five days after swallowing the coin she was brought to the Ponce de Leon Infirmary where X ray revealed the coin caught in the lower third of the esophagus To our great relief the Berman *locator* buzzed loudly as it was brought over the chest (Mussolini did not use silver or copper to make coins during the war Indeed, in 1911 our own government minted pennies of iron) The child was anesthetized and through an esophagoscope the magnet was passed Contact was established and the coin quickly extracted It was fortunate that it did not remain longer in the esophagus for examination after the coin had been removed revealed beginning pressure necrosis

Because babies have the inveterate propensity of putting into their mouths everything they can get hold of, because they are brought up amid safety pins and because their mothers forget the importance of leaving no open safety pins within a baby's reach, one of the most common foreign bodies found in a baby's esophagus is an open safety pin, with the point up When an open safety pin is found in the esophagus

X ray revealed the pin in the stomach The stomach was inflated and the magnet brought out point first The child went home well 36 hours later

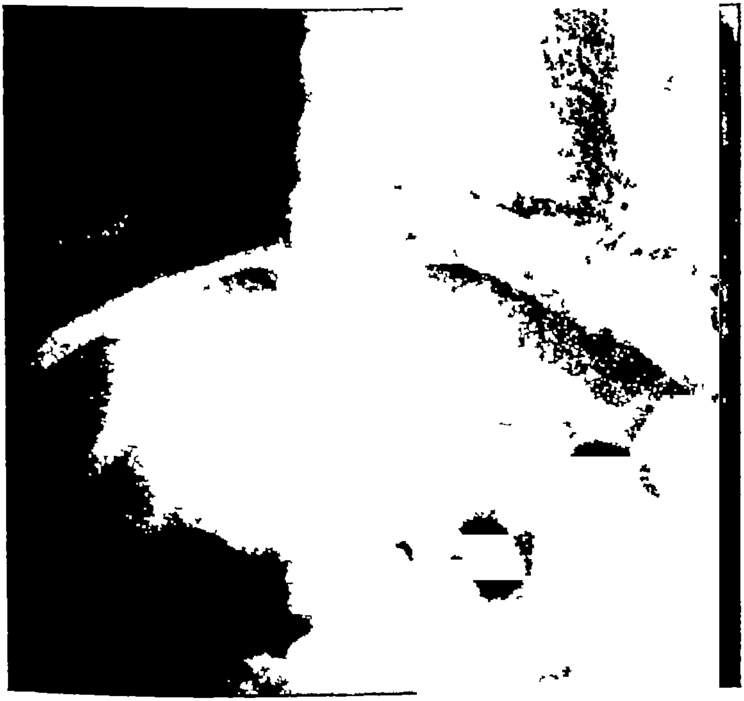


Fig 2 (A) The corsage pin in the stomach of a child of seven (Case 3)

Case 4 Five-year-old William was a carpenter's son Playing with his father's tools, he swallowed a staple Though free of symptoms he was sensible enough to tell his father who brought him at once to the infirmary About half an hour after he swallowed the staple X ray revealed it in the stomach (see Fig 3 A) This two-pronged staple was too dangerous to leave there, so it was at once removed with a magnet the bend of the staple up the points trailing The boy went home two days later

THE DUODENUM

Prior to May 7, 1947, when a metallic foreign body had passed the pylorus, the attending physician had his choice of watchful waiting or of submitting the patient to the hazardous operation of duodenotomy While, of course, many such objects do pass on through the gastrointestinal canal without

The fourth and simplest method, providing only that the safety pin is of steel, is to use a manget Several such cases have already been reported from the Ponce de Leon Infirmary[2]

A magnet of suitable size is attached to a Levin tube, which encases a semiflexible wire, and which is attached to a hand bellows The magnet is passed down the esophagus, dragging the safety pin with it, the point harmlessly trailing, into the stomach The stomach is then inflated with the hand bellows and the magnet manipulated under fluoroscopic guidance until the safety pin is reversed Magnet and pin are then drawn back up the esophagus without injury and the baby is often sent home well the following day

THE STOMACH

Though adults occasionally swallow the most extraordinary objects, most metallic foreign bodies in the stomach have been swallowed by children The first thing to do is to determine if the foreign body has passed beyond the pylorus If the X-ray is taken with the child lying on his back and the stomach inflated, the spinal column projects upward and the lowest part of the stomach is the fundus If the foreign body lies in the fundus, particularly if several plates show some difference in its position, one can be sure it is in the stomach If, however, all plates show the foreign body across the spinal column or to the right of it, it is probably in the duodenum For intragastric work we use a magnet on a semiflexible wire with a Levin tube as just described A curve in the magnet enables the operator to have better control of it Sometimes, however, we are content to use a magnet tied to a string

Here are a couple cases of some unusualness

Case 3 Dorothy, a young lady of six primping for a dance and trying to decide where to place the bouquet her date's mother had sent her swallowed the corsage pin Considering the dance the most important thing in her life — social life begins early in Atlanta — she did not tell her parents of the accident until she came home from the party four hours later She was brought to the Ponce de Leon Infirmary at 10 p m

Xray revealed the pin in the stomach The stomach was inflated and the magnet brought out point first The child went home well 36 hours later

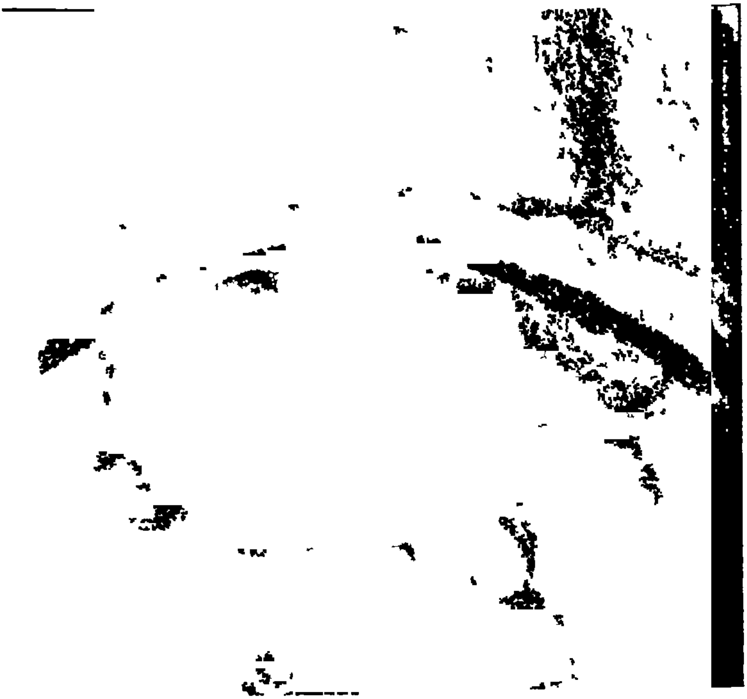


Fig 2 (A) The corsage pin in the stomach of a child of seven (Case 3)

Case 4 Five-year old William was a carpenter's son Playing with his father's tools, he swallowed a staple Though free of symptoms he was sensible enough to tell his father, who brought him at once to the infirmary About half an hour after he swallowed the staple Xray revealed it in the stomach (see Fig 3 A) This two pronged staple was too dangerous to leave there so it was at once removed with a magnet the bend of the staple up, the points trailing The boy went home two days later

THE DUODENUM

Prior to May 7, 1947, when a metallic foreign body had passed the pylorus, the attending physician had his choice of watchful waiting or of submitting the patient to the hazardous operation of duodenotomy While, of course, many such objects do pass on through the gastrointestinal canal without

Fig 3 (A) The staple in the little boy's stomach (Case 1)

causing any symptoms, in our opinion if it has a point or a sharp, jagged edge it is best to try to remove it at once from above, or if the object is relatively long and observation for a few days indicates that it will not get by the ligament of Treitz, every effort should be made to extract it with a magnet

At the 1947 meeting of the American Medical Association we claimed that the first removal of a metallic foreign body from the duodenum from above had been performed at the Ponce de Leon Ear, Nose and Throat Infirmary on May 7 of

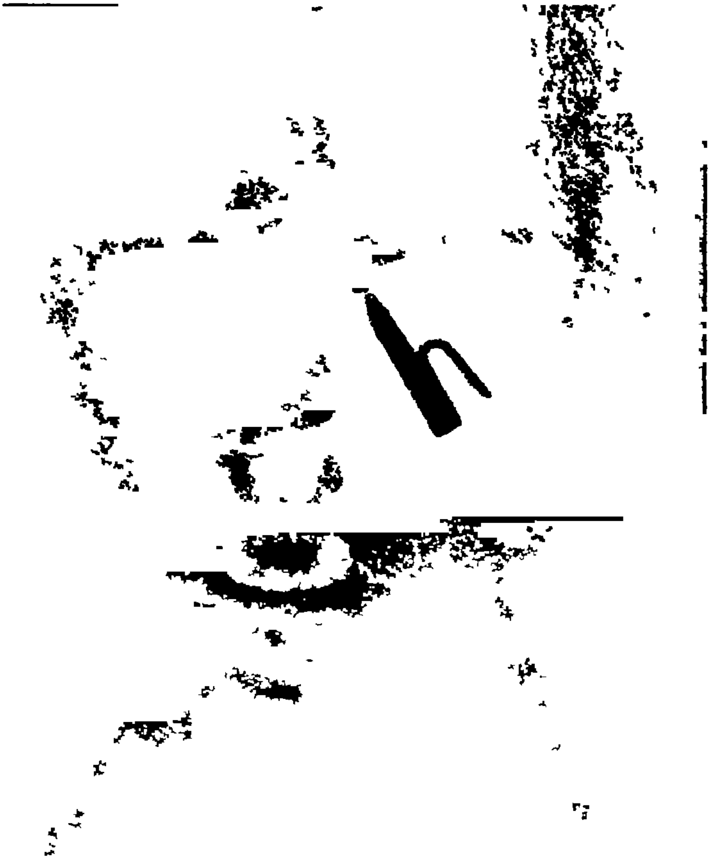


Fig 3 (B) The staple is being withdrawn. As with open safety pins it was necessary to be sure that the staple was attached to the magnet so that the points would trail (Case 4)

that year The report was published in the *Journal of the American Medical Association*[3] a few months later, and the claim has not been challenged Six additional cases have been seen by us since. In two the foreign body had become so fixed in the duodenum that it was impossible to dislodge it and the children were submitted to an open operation Although both finally recovered, the seriousness of their courses made us more enthusiastic than ever about removal of such objects with the magnet The second[4] and third[5] cases successfully treated have already been reported, and the fourth will be

Here is the fifth case of magnetic removal of a foreign body from the duodenum at our infirmary, which is probably the fifth case in history

Fig 4 (A) The shadow of the bobby pin lies across the spine (Case 5)

Case 5 Sandra was six Two days before admission to the infirmary at 10 p m she had swallowed a bobby pin Although she was experiencing no symptoms X ray revealed the bobby pin in the third portion of the duodenum Her jaws were held open with a gag and a magnet tied to an opaque string was pushed digitally into her esophagus She was then given a soft drink which carried it into her stomach Her arms were immobilized in cardboard splints to prevent her pulling it out and a special nurse kept her mostly on her right side during the night to secure the aid of gravity in getting the magnet by the pylorus

Sometimes the patient reports that he feels a click inside that denotes the contact has been established between the magnet and the foreign body In this case, however, we did not learn of the contact until an Xray was secured at nine the next morning The child was promptly anesthetized to secure relaxation and while she was under the fluoroscope gentle traction was exerted on the string When the magnet and foreign body were in the stomach an esophagoscope threaded around the string was inserted and the withdrawal completed The child was sent home well two days later

Fig 4 (B) Lateral view with barium in the stomach proves that the pin is in the duodenum (Case 5)

The original technique of removing metallic bodies from the duodenum has been altered in two respects A radio-opaque string, prepared for us at the Georgia Institute of Technology, is, we believe, helpful in enabling us at all times to find out the position of the string The esophagoscope prevents trauma in the esophagus and also prevents stripping the magnet of the foreign body at the cricopharyngeal constriction

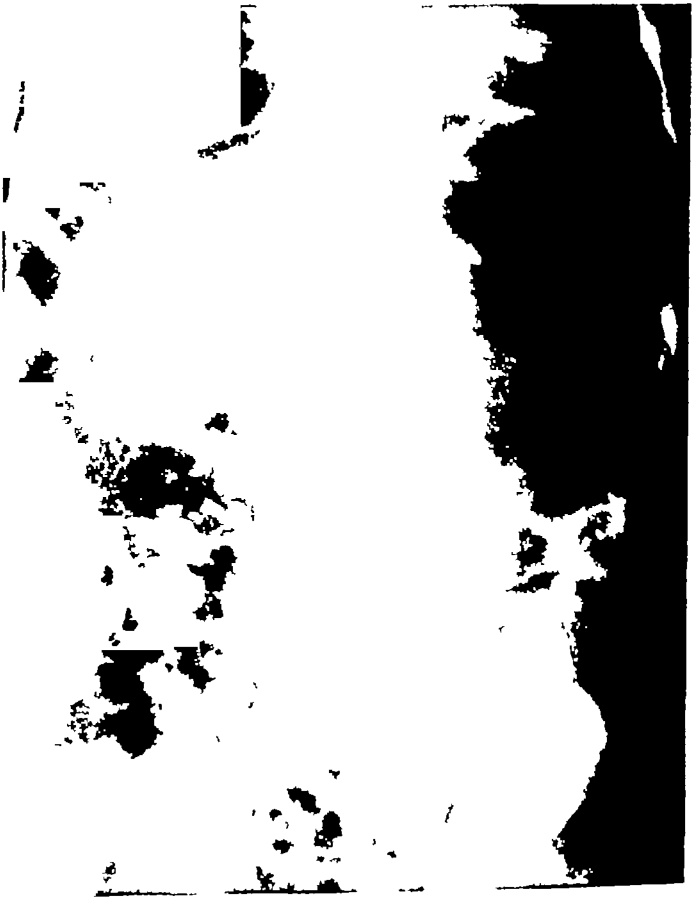


Fig 1 (C) Nine hours later the magnet has met the bobby pin in the stomach The opaque string can be seen along the greater curvature of the duodenum (Case 5)

SUMMARY

Five years' experience with the alnico permanent magnet (sometimes as a cylinder fixed to a rather rigid ureteral catheter, and thin enough to pass through a 4 mm bronchoscope, sometimes as a stubby curved affair tied to an opaque string, sometimes with other modifications) have convinced us that it provides the quickest and safest, the least traumatic method of removing ferrous foreign bodies from the lungs, esophagus, stomach and duodenum It is the easiest and surest way to remove such objects from the stomach and the only way — short of a serious open operation — that they can be removed from the duodenum

REFERENCES

1 JACKSON, CHEVALIER Magnetic Aid in the Bronchoscopic and Esophagoscopic Removal of Foreign Bodies from the Air and Food Passages *Ann Otol, Rhinol and Laryngol*, 37 435 June, 1928, also, *Proc Amer Bronchoscopic Soc*, 1927

2 TUCKER, GABRIEL A Flexible Gastroscopic Forcep with Magnetic Tip *Tran Amer Broncho-Esophagological Assn.*, p 17 1946

3 HOLINGER, PAUL H Magnets for Extraction of Foreign Bodies from Air and Food Passages *Tran Amer Broncho Esophagological Assn*, pp 18-19, 1946

4 EQUEN, MURDOCK Magnetic Removal of Foreign Bodies from the Food and Air Passages Under Fluoroscopic Guidance *South Med Jour*, 38 245 246, Apr., 1945

5 EQUEN, MURDOCK Magnetic Removal of Foreign Bodies from the Food and Air Passages *Arch Otolaryngol*, 46 225 229 Aug 1947

6 EQUEN, MURDOCK GILLIAM ROBERT, and LINEBACK MERRILL Nail in Duodenum Removed by Magnet *Jour A M A*, 135 432, Oct 18, 1947

7 EQUEN, MURDOCK Foreign Bodies in the Duodenum *South Med Jour*, 41 187 191 Mar, 1948

8 EQUEN MURDOCK Foreign Bodies in the Duodenum and Magnetic Influence in Bronchoscopy THE LARYNGOSCOPE, 58 726 734, July 1948

STAPEDIOPARALYTIC PHONOPHOBIA ("HYPERACUSIS") IN A DEAF EAR

Case Reports Including Studies on the Analysis of the Phenomenon and Suggestions for Possible Applications of the Phonophobia Test.*

KURT TSCHIASSNY, M.D.,
Cincinnati, Ohio

THE FUNCTION OF THE STAPEDIUS MUSCLE

For about a century the protection of the inner ear was regarded to be the function of the stapedius muscle. J. Mueller,[1] in 1943, wrote that the influence of this muscle in hearing is unknown. "The only effect which it appears to me could be ascribed to it could be to render tense the membrane by which the base of the stapes is connected with the margin of the fenestra." Erhard,[2] in an address presented at the meeting of the Berlin Medical Society (1868), said definitely: "If Mr. von Troeltsch calls the tensor veli palatini on account of its action the abductor tubae, one could call the tensor tympani the compressor cavitatis and the stapedius muscle the tutor labyrinthi." Although the majority of investigators adhered to the protection theory, there were a few authorities (Lucae,[3] Hitzig,[4] Urbantschitsch[5] and others) who attributed to the middle ear muscles the particular auditory function of adjusting the tension of the eardrum and ossicular chain to the varieties of pitches. The stapedius muscle sometimes was even considered to be "the muscle of listening." The action

---

*From the Department of Otolaryngology, University of Cincinnati College of Medicine.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Aug. 13, 1948.

of the two muscles was regarded as antagonistic, one of them contracting on lower notes, the other one on higher notes, and relaxing vice versa

This concept was first disproved by Toru Kato's[6] animal experiments in 1913 He demonstrated that weak stimuli do not change the condition of the muscles Stronger stimuli produce appropriate contraction of the stapedius muscle Increasing intensities are accompanied by contraction of the tensor Exceedingly strong stimuli effect a tetanic contraction of both muscles These reflexes are dependent on the integrity of the inner ear They appear bilaterally on unilateral stimulation They disappear when the inner ear is destroyed Kato came to the conclusion that by contraction of these muscles diminution of the amplitude of the vibrating structures is achieved and the impact onto the labyrinth diminished This concept was particularly supported by the observation of the more rapidly developing damage to the cochlea with acoustic traumatization in those cases in which these muscles were paralyzed and inactivated experimentally, therefore, both of them are to be regarded as synergistic protectors of the labyrinth the stapedius reflex being the more sensitive reaction appearing first, while the tensor reflex appears in addition when activated by stronger stimuli

Luescher[7] (1929) was the first to study the stapedius reflex in man by direct observations through a dry perforation in the upper superior quadrant by means of an ear microscope He observed the reflex with stimuli of between 90 dv and 14,000 dv Noises were even more effective than pure tones There was no reaction to whisper Smaller intensities produced only a brief contraction This cochlear-stapedius reflex was elicited by stimuli applied to either ear and appeared even as a psychic reaction when the patient anticipated a stimulus Tactile stimuli applied to the external ear at areas supplied by the third cervical nerve effected a moderate reaction Luescher[7] came to the conclusion that in the "centripetal portion of the reflex arch the nervus cochlearis occupies the first position, whereas sensory receptors play a minor rôle, if any at all" The theory that stapedius contraction increases the hearing acuity appears definitely disproved The muscle is shown to contract only on acoustic stimuli of higher intensities, therefore, it acts as a damping mechanism

Luescher's observations were confirmed and enlarged upon by extensive studies of Kobrak,[8, 9] particularly in cooperation with Lindsay, Perlman, Dubner[10-12] and by others These authors used for their studies, besides Luescher's method, a technique described by Kobrak[8] An "optic perforation" was obtained by artificially making the eardrum translucent Measuring quantitatively the threshold of the stapedius reflex relative to the threshold of hearing at the various frequencies, they found a striking parallelism between the two curves The reflex was proved to depend definitely on the function of the cochlea It appeared equally on crossed and uncrossed stimulation It was restricted in cases of bilaterally impaired hearing, it appeared also on stimuli applied by bone conduction, and was abolished with general anesthesia

PHONOPHOBIA

Paralysis of the stapedius muscle is associated with a painful sensation in the ear of the paralyzed side when strong acoustic stimuli are applied

According to W Erb,[13] this phenomenon was first observed by Roux in his own case and became well known through Landouzy's treatise (1851) Credit is paid to the same author by Hitzig[4] and by Bazire[11] A discussion of the various concepts on the mechanism of the phenomenon as was presented by authorities such as Hitzig,[4] Lucae,[3] Brown-Sequard,[14] *Urbantschitsch*[15] and others, being only of historical interest, shall be omitted Erb[13] deserves credit for introducing this symptom as a diagnostic aid in localizing the site of the lesion in instances of facial nerve paralysis

The terminology of the phenomenon was frequently changed (Gruenberg[16]), as mentioned by the writer[17] in a previous article, "It was sometimes called 'hyperacusis', but as his been repeatedly observed, this term is rather incorrect, since there is no increased acuity of the organ of hearing, but only increased sensitivity for auditory stimuli For this reason, terms such as hyperesthesia acustica, hyperalgesia acustica, hyperesthesia dolorosa, dysacusis have been recommended Obviously none of these terms is quite appropriate In my opinion, this phenomenon represents a close analogy to the ophthalmic phenomenon which is characterized by 'photophobia' The irritating factor in the case of the eye is light [Greek phos(phot), in the case of the ear, sound (Greek phone)] Accordingly, I take the liberty to suggest the use of the word 'phonophobia' for designating the symptom of hypersensitivity for auditory stimuli"

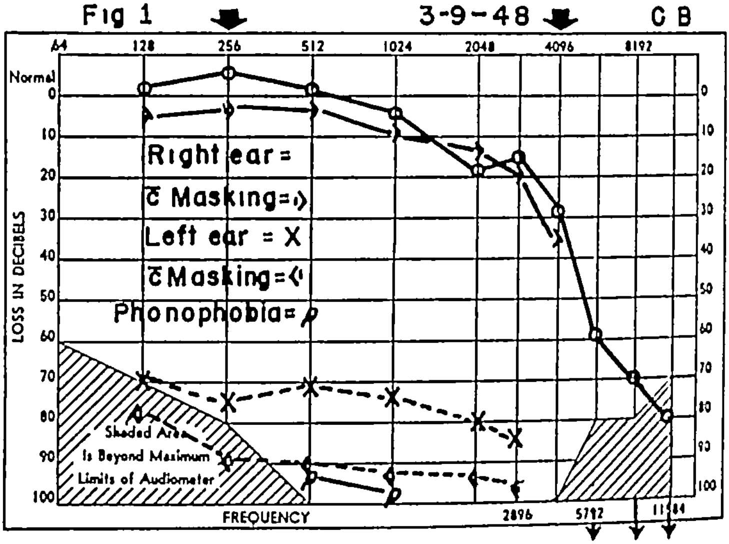
Hyperacusis or phonophobia, as the author wishes to call it now, represents, in other words, a depression of the threshold of feeling below normal levels, however, such a condition can be caused by a variety of factors besides neuropathic inactivation of the stapedius reflex (Politzer,[18] Urbantschitsch[5]), therefore, it might be justified to designate the type observed in association with Bell's palsy as "stapedioparalytic phonophobia" (S P P)

The recent advances of our knowledge on the function of the stapedius muscle aroused increased interest in studies of this symptom Perlman[19] reported interesting observations obtained by his studies on the phenomenon in a case of Bell's palsy He found particularly increased fatigability, enlarged masking effect, and delayed recovery time on the paralyzed side in comparison with the normal The curve of phonophobia threshold paralleled the curve of hearing threshold The former appeared at levels such as are known to represent the threshold of stapedius contraction when stimuli are applied under normal circumstances

AUTHOR'S STUDIES

The rare coincidence of Bell's palsy in a patient with unilateral complete deafness involving the side of the deaf ear presented to the writer the occasion for some observations and studies by which additional information on the subject was obtained

Fig 1



Case 1 Chester B, age 42, colored, factory worker came on March 19 1948, to the ear, nose and throat clinic for left facial paralysis which he had noticed for two days The condition was preceded by some pain and dullness on the paralyzed side He never was sick before except for an injury in the neck suffered in a fight 25 years ago He had been completely deaf in his left ear for 22 years Deafness resulted from target shooting, which he practiced when serving in the National Guard Examination revealed a complete paralysis of the left facial nerve involving its entire distribution There was marked Bell's phenomenon normal lacrimation, and absence of taste sensation for all four qualities on the left anterior part of the tongue Marked phonophobia was manifested when, at the frequencies of 512 dv and 1024 dv intensities above 90 db and 95 db, respectively were applied When these intensities were induced, the patient immediately removed the receiver from the ear saying "It hurts!" The phenomenon was sometimes to a milder degree present at 2048 dv and was absent at higher frequencies and at those below 512 dv, even when the strongest intensities were applied Weber to the right, Schwabach shortened Rinne positive on the right no air conduction on the left Audiometric as shown in the chart (see Fig 1) The hearing curve of the left ear was obviously "shadow" hearing since the threshold was considerably raised with masking of the right ear Practically no change in the hearing threshold of the right ear was brought about by masking the left ear Lombard's test was definitely positive Accentuated loud voice *ad aurem* was not heard when the right ear was masked The left ear appeared to be completely deaf Eardrums were normal Nose and throat normal Vestibular examination revealed no spontaneous manifestations and normal caloric reactions equal on both sides

Course Vitamin B complex was prescribed and massage and heat applications recommended The patient was seen again on March 9 1948 and on March 17 1948 On these and on subsequent occasions the studies were performed which are reported in detail below The condition gradually improved Bell's phenomenon disappeared Taste returned Phonophobia however persisted at the frequencies of 512 dv and 1024 dv On March 31 there was only a slight weakness on closing the eyes and on whistling Phonophobia was still present. Patient did not keep appointments and was seen again only on July 14 There was present only a slight weakness involving the mouth branch Testing for phonophobia however revealed definite pain sensation with application of intensities above 90 db and 95 db at the frequencies of 512 dv and 1024 dv

THE PROBLEM

Presence of hypersensitivity for auditory stimuli in the absence of any ipsilateral auditory function was regarded as a rather paradoxical phenomenon The problem in this case revolved about the question What is the neural mechanism responsible for phonophobia in a deaf ear?

In planning the search for the analysis of the problem, the following four explanations were considered

I Phonophobia might have been present in a latent state preceding the, and entirely independent of the, facial paralysis It might be the manifestation of a psychic factor conditioned years ago when the patient experienced the damage of his left ear caused by strong auditory sensations

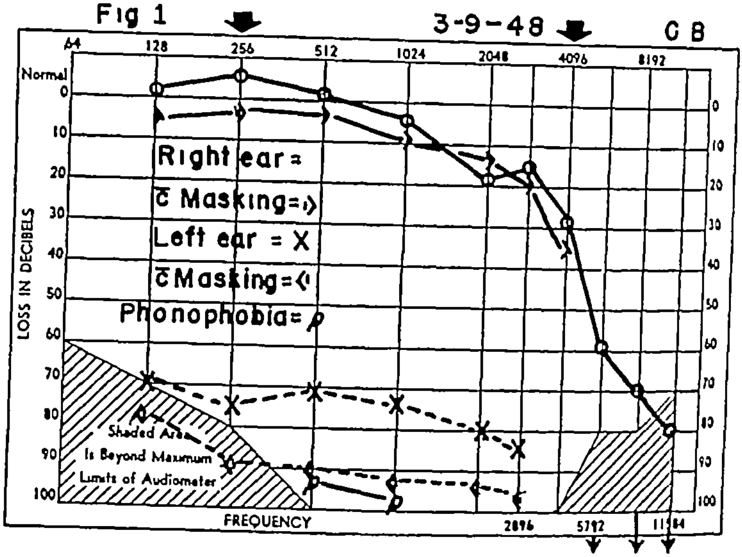
II It might be caused by the stapedius paralysis of recent origin and activated by auditory stimuli applied to the deaf ear, but perceived in the opposite ear by the mechanism of "shadow hearing"

III The phenomenon might not depend on hearing at all, but might be caused by vibratory sensation of tactile character, the threshold of feeling being depressed by paralysis of the stapedius muscle Lierle and Reger[20] have shown the threshold of feeling to be about equal in a deaf ear to that in a normal ear

IV The phenomenon might depend on the joint influence of both factors

presented to the writer the occasion for some observations and studies by which additional information on the subject was obtained

Fig 1



Case 1 Chester B , age 42, colored, factory worker, came on March 19 1948, to the ear, nose and throat clinic for left facial paralysis which he had noticed for two days The condition was preceded by some pain and dullness on the paralyzed side He never was sick before except for an injury in the neck suffered in a fight 25 years ago He had been completely deaf in his left ear for 22 years Deafness resulted from target shooting, which he practiced when serving in the National Guard Examination revealed a complete paralysis of the left facial nerve involving its entire distribution There was marked Bell's phenomenon normal lacrimation, and absence of taste sensation for all four qualities on the left anterior part of the tongue Marked phonophobia was manifested when, at the frequencies of 512 dv and 1024 dv , intensities above 90 db and 95 db , respectively were applied When these intensities were induced, the patient immediately removed the receiver from the ear saying "It hurts!" The phenomenon was sometimes to a milder degree present at 2048 dv and was absent at higher frequencies and at those below 512 dv even when the strongest intensities were applied Weber to the right Schwabach shortened, Rinne positive on the right no air conduction on the left Audiometric as shown in the chart (see Fig 1) The hearing curve of the left ear was obviously shadow" hearing since the threshold was considerably raised with masking of the right ear Practically no change in the hearing threshold of the right ear was brought about by masking the left ear Lombard s test was definitely positive Accentuated loud voice *ad aurem* was not heard when the right ear was masked The left ear appeared to be completely deaf Eardrums were normal Nose and throat normal Vestibular examination revealed no spontaneous manifestations and normal caloric reactions equal on both sides

Course Vitamin B complex was prescribed and massage and heat applications recommended The patient was seen again on March 9 1948 and on March 17 1948 On these and on subsequent occasions the studies were performed which are reported in detail below The condition gradually improved Bell s phenomenon disappeared Taste returned Phonophobia however persisted at the frequencies of 512 dv and 1024 dv On March 31 there was only a slight weakness on closing the eyes and on whistling Phonophobia was still present. Patient did not keep appointments and was seen again only on July 14 There was present only a slight weakness involving the mouth branch Testing for phonophobia however revealed definite pain sensation with application of intensities above 90 db and 95 db at the frequencies of 512 dv and 1024 dv

THE PROBLEM

Presence of hypersensitivity for auditory stimuli in the absence of any ipsilateral auditory function was regarded as a rather paradoxical phenomenon The problem in this case revolved about the question What is the neural mechanism responsible for phonophobia in a deaf ear?

In planning the search for the analysis of the problem, the following four explanations were considered

I Phonophobia might have been present in a latent state preceding the, and entirely independent of the, facial paralysis It might be the manifestation of a psychic factor conditioned years ago when the patient experienced the damage of his left ear caused by strong auditory sensations

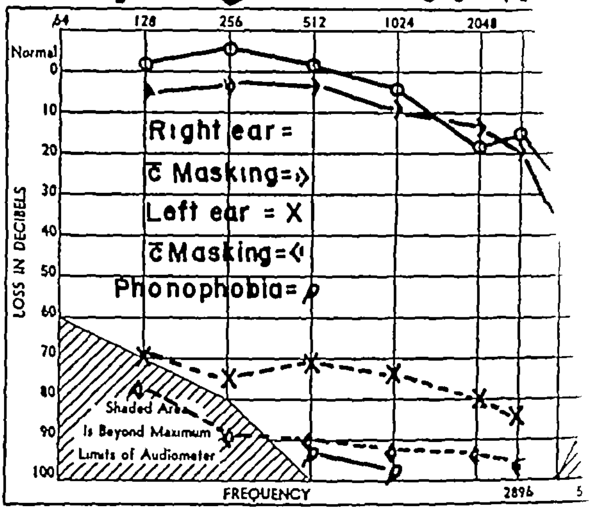
II It might be caused by the stapedius paralysis of recent origin and activated by auditory stimuli applied to the deaf ear, but perceived in the opposite ear by the mechanism of "shadow hearing"

III The phenomenon might not depend on hearing at all, but might be caused by vibratory sensation of tactile character, the threshold of feeling being depressed by paralysis of the stapedius muscle Lierle and Reger[20] have shown the threshold of feeling to be about equal in a deaf ear to that in a normal ear

IV The phenomenon might depend on the joint influence of both factors

presented to the writer the occasion t
and studies by which additional inform
was obtained

Fig 1 3-9-48



Case 1 Chester B , age 42, colored, factory worker, c
1948 to the ear nose and throat clinic for left facial p
had noticed for two days The condition was preceded b
dullness on the paralyzed side He never was sick befo
injury in the neck suffered in a fight 25 years ago H
pletely deaf in his left ear for 22 years Deafness resul
shooting, which he practiced when serving in the National
nation revealed a complete paralysis of the left facial n
its entire distribution There was marked Bell s phenom
lacrimation, and absence of taste sensation for all four q
left anterior part of the tongue Marked phonophobia w
when, at the frequencies of 512 dv and 1024 dv intensiti
and 95 db respectively were applied When these int
induced, the patient immediately removed the receiver f
saying "It hurts!" The phenomenon was sometimes to a m
present at 2048 dv and was absent at higher frequencies
below 512 dv, even when the strongest intensities were app
to the right Schwabach shortened, Rinne positive on the r
conduction on the left Audiometric as shown in the chart (
The hearing curve of the left ear was obviously "shadow" h
the threshold was considerably raised with masking of th
Practically no change in the hearing threshold of the righ
brought about by masking the left ear Lombard s test wa
positive Accentuated loud voice *ad aurem* was not heard whe
ear was masked The left ear appeared to be completely deaf
were normal Nose and throat normal Vestibular examination
no spontaneous manifestations and normal caloric reactions
both sides

Course Vitamin B complex was prescribed and massage and heat applications recommended The patient was seen again on March 9 1948 and on March 17 1948 On these and on subsequent occasions the studies were performed which are reported in detail below The condition gradually improved Bell s phenomenon disappeared Taste returned Phonophobia however persisted at the frequencies of 512 dv and 1024 dv On March 31 there was only a slight weakness on closing the eyes and on whistling Phonophobia was still present Patient did not keep appointments and was seen again only on July 14 There was present only a slight weakness involving the mouth branch Testing for phonophobia however revealed definite pain sensation with application of intensities above 90 db and 95 db at the frequencies of 512 dv and 1024 dv

THE PROBLEM

Presence of hypersensitivity for auditory stimuli in the absence of any ipsilateral auditory function was regarded as a rather paradoxical phenomenon The problem in this case revolved about the question What is the neural mechanism responsible for phonophobia in a deaf ear?

In planning the search for the analysis of the problem, the following four explanations were considered

I Phonophobia might have been present in a latent state preceding the, and entirely independent of the, facial paralysis It might be the manifestation of a psychic factor conditioned years ago when the patient experienced the damage of his left ear caused by strong auditory sensations

II It might be caused by the stapedius paralysis of recent origin and activated by auditory stimuli applied to the deaf ear, but perceived in the opposite ear by the mechanism of "shadow hearing"

III The phenomenon might not depend on hearing at all, but might be caused by vibratory sensation of tactile character, the threshold of feeling being depressed by paralysis of the stapedius muscle Lierle and Reger[20] have shown the threshold of feeling to be about equal in a deaf ear to that in a normal ear

IV The phenomenon might depend on the joint influence of both factors

EXAMINATIONS

With these considerations in mind, a series of studies was performed on March 17 and some on later occasions

1 The patient was asked whether he ever experienced discomfort in either one of his ears with loud sounds or noises of any kind at any time before the onset of Bell's palsy The answer was definitely no

2 The threshold of phonophobia was determined at the left (deaf) ear by suddenly releasing the sound interruptor at various frequencies and intensities It appeared to be at a level somewhat above 90 db and 95 db when frequencies of 512 dv and 1024 dv were applied

3 Application of maximum intensities at those or other frequencies at the right ear was only felt as "awfully loud ' No pain at either ear was noticed

4 The masking buzzer was applied to the right ear while phonophobia was tested for at the left ear in the manner described under 2 Patient, as a rule manifested phonophobia He noticed pain and sometimes almost reflexly removed the sound receiver however his responses appeared somewhat inconsistent For this reason the arrangement of the experiment was changed when it was repeated at a later occasion This time both receivers were first applied simultaneously while the intensities at the critical frequencies were increased gradually No phonophobia was manifested this time even at the highest possible intensities however when the examiner himself suddenly removed the masking receiver phonophobia of shock like character appeared instantly

5 This was abolished immediately by placing the masking buzzer back again

6 Sensory stimuli of nonacoustic character such as produced by pressure changes in the external meatus by means of Siegle's otoscope by blowing air at the structures of the external ear and at the ear drum and by syringing the ear canals did not produce phonophobia No difference was felt when these procedures were performed alternately on either side

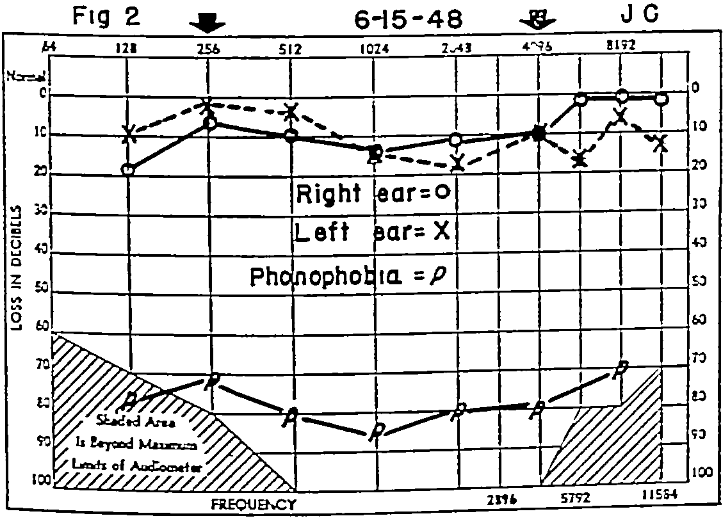
7 Bonain's solution was instilled in the left ear On examination for phonophobia after 10 minutes the phenomenon was still present. The patient could not tell of any difference in the intensity of the pain however he noticed some undeterminable changes in its location

8 Ten per cent cocaine solution was insufflated by means of a Eustachian tube catheter No particular discomfort was produced by this procedure except for a "lump in the throat ' When after several minutes he was tested for phonophobia the phenomenon appeared to be completely abolished even when the strongest intensities were applied to the paralyzed side

9 There was no change after 10 minutes After 20 minutes when the test was repeated, a sort of ticklin' was felt after 30 minutes S P P returned with the same character and intensity as before

Another case of Bell's palsy associated with S P P in a patient with bilateral practically normal hearing, observed only recently, was the occasion for repeating the above mentioned studies

Fig 2



Case 2 Joanne C age 18 years came to the ear nose and throat clinic on June 15 1948 for right facial paralysis present for about one week Previous history was noncontributive Patient was in her ninth month of pregnancy Examination revealed all branches of the VIIth nerve on the right side were involved Bell s phenomenon present. Taste absent. Lacrimation present. Hearing almost normal on both sides (see Fig 2) S P P appears over all frequencies at levels between 55 db and 70 db above and to some extent paralleling the curve of hearing threshold

Course Vitamin B complex was prescribed and massage and heat application recommended The condition improved rapidly After one week motion in the upper portion of the face returned. Bell s phenomenon disappeared. S P P appeared to be less pronounced Some taste was present. On June 30 phonophobia test revealed no discomfort on any frequency even when highest intensities were applied. July 18 delivery July 25 S P P absent. Taste normal. Considerable weakness at the oral branch still present

EXAMINATIONS

On June 18, identical studies as outlined in the first case were performed The results were practically the same except for the following differences

1 On masking the opposite ear, the threshold of S P P was practically the same as without masking

2 On insufflation of cocaine solution, S P P disappeared only for 15 minutes, however, the possibility of a smaller amount of cocaine having been applied this time cannot be ruled out

3 Subsequent to cocaine insufflation a temporary diminution of the hearing at the lower frequencies was noticed

Most of these studies were watched by the residents, Dr Dershley and Dr Hogg The cases were presented at staff meetings

CONCLUSIONS

In applying the information obtained by these studies relative to the four conditions that were considered to represent factors possibly responsible for the neural mechanism of S P P in a deaf ear, the following conclusions are justified

I The possibility of a pyschic factor can be discarded on account of examinations 1 and 3

II Unimpaired "shadow hearing" by means of the opposite ear represents an integral factor in activating the phenomenon Evidence obtained by examinations 2, 4 and 5

III Unimpaired tactile sensitivity of the ipsilateral middle ear structures for acoustic stimuli represents an integral factor in the phenomenon, whereas it is practicaly not influenced by tactile sensation of the external ear, including the external surface of the eardrum Evidence obtained by examinations 6, 7, 8 and 9 and confirmed by examinations in Case 2

IV Accordingly, the joint presence of both factors unimpaired hearing in the opposite ear and unimpaired tactile sensitivity of the ipsilateral middle ear structures represents the requirements for possibly activating the neural mechanism responsible for S P P in a deaf ear With absence of either one of these two factors S P P is abolished

Among the possibilities considered previously condition IV represents the answer to the problem at issue

COMMENTS

New Information Resulting from These Studies

Several new pieces of information on the subject of S P P are apparent from these studies in the reported two cases

1 S P P is observed in a case of complete inner ear deafness on the paralyzed side with normal hearing in the opposite ear The phenomenon appears practically restricted to the frequencies of 512 dv and 1024 dv with application of intensities of 20 db to 25 db above the shadow' curve

2 S P P is abolished with masking the opposite ear By this procedure the 'shadow' curve at the critical frequencies is raised to such levels that the maximum increase of available intensities is less than 10 db

3 S P P reappears momentarily with removing the masking receiver from the opposite ear

4 Masking the opposite ear in a case of bilateral normal hearing hardly influences the threshold of S P P

5 Stimuli of nonacoustic character applied to the external ear do not elicit S P P in either case

6 With anesthetics applied to the external surface of the eardrum S P P persists in either case

7 With 10 per cent cocaine solution insufflated via Eustachian tube S P P is abolished in either case

8 The phenomenon reappears after a period of time apparently coinciding with the disappearance of the cocaine effect.

9 In general S P P appears to be dependent on the joint presence of two factors *a* normal hearing present at least on one side and *b* unimpaired tactile sensitivity of the middle ear structures on the paralyzed side

10 With interference with either one of these two factors the phenomenon is abolished

CONDITIONS RESPONSIBLE FOR THRESHOLD OF S P P COMPARED WITH THOSE CONTROLLING THE THRESHOLD OF FEELING

S P P represents a depression of the individual threshold of feeling due to the absence of the protective stapedius reflex There are, however, some principal differences between conditions controlling the threshold of S P P and those responsible for the common threshold of feeling Fundamental information on the latter subject was presented by Lierle and Reger [20]

1 Threshold of feeling was shown by these investigators to be independent from the condition of the cochlea, being practically the same in a deaf ear as in a normal ear Contrariwise, S P P is definitely dependent on the threshold of changes in pupillary reaction, bradycardia, labyrinthine symptoms and lengthening of bone conduction, as mentioned by this author as occurring subsequent to cocaine instillation, cannot be regarded as signs sufficient for indicating tympanic muscle paralysis

Information regarding the effect of locally applied cocaine on the stapedius reflex has not yet been presented

EFFECT OF LOCAL ANESTHETICS ON S P P

By the present studies the definite information was obtained that cocaine insufflated into the Eustachian tube abolishes S P P The writer is not in the position to offer a definite explanation on the mechanism responsible for this effect Two possible modes of action may be considered

1 Cocaine causes anesthesia of the peripheral neural receptors (of undetermined location) responsible for the pain manifested in S P P

2 Cocaine inactivates the peripheral neural receptors responsible for initiating the stapedius reflex Pain such as caused by stapedius paralysis when its contraction is called for, may probably not appear under a condition such as not to necessitate the action of the muscle in its capacity as "tutor labyrinthi"

Future investigation may possibly reveal information about the influence of cocaine on the stapedius reflex by direct observation through an open or "optical" window

In the writer's opinion, investigations to this effect seem to be of considerable importance A clear cut understanding of all the factors responsible for the mechanism of S P P is the prerequisite for a possible clinical application of the phonophobia test

Observation of the presence or absence of direct and/or consensual reaction associated with or without phonophobia could provide appropriate information

TECHNIQUE OF THE PHONOPHOBIA TEST

To the author, the test appears to include necessarily two parts

A Determination of the threshold of pain (if any) manifested on sudden release of the interruptor at the various frequencies

B Determination of disappearance or persistence of phonophobia subsequent to cocaine insufflation In the case of persistence some extratympanic factor should probably be considered as responsible for the phenomenon.

SUGGESTIONS FOR PRACTICAL APPLICATIONS OF THE PHONOPHOBIA TEST

I *As a Possible Support in the Diagnosis of Otosclerosis*

As mentioned already, hypersensitivity for acoustic stimuli is observed to occur occasionally in conditions other than Bell's palsy In this concern, Politzer[15] writes "Hyperesthesia acustica is a painful sensation in the ear which is produced by tones and noises and which is also found in persons of normal hearing when the highest tones are elicited near the ear Anemic, nervous, hysterical, etc, persons are often unpleasantly affected by certain tones and noises This painful perception for noises is a symptom which frequently accompanies hemicrania, trigeminal neuralgia and a beginning or developed cerebral affection Hyperesthesia acustica is, however, most often met with in acute and chronic affections of the middle ear and labyrinth, especially in the severe form of otosclerosis In these cases the sensitivity for noises is often disproportionate to the disturbance of hearing as it has frequently been found that when there is complete deafness there is still hyperesthesia acustica "

Urbantschitsch,[5] presenting a rather comprehensive casuistic from the literature and from observations of his own, emphasizes differentiation between real hyperesthesia acustica on one hand and a condition merely characterized by discomfort and pain for loud noises and sounds on the other hand "In these cases the increased sensitivity does not involve the acoustic nerve but the sensory nerves and only appears to be changes in pupillary reaction, bradycardia, labyrinthine toms and lengthening of bone conduction, as mention this author as occurring subsequent to cocaine instill cannot be regarded as signs sufficient for indicating tym muscle paralysis

Information regarding the effect of locally applied coc on the stapedius reflex has not yet been presented

EFFECT OF LOCAL ANESTHETICS ON S P P

By the present studies the definite information was tained that cocaine insufflated into the Eustachian t abolishes S P P The writer is not in the position to offe definite explanation on the mechanism responsible for t effect Two possible modes of action may be considered

1. Cocaine causes anesthesia of the peripheral neural rece tors (of undetermined location) responsible for the p manifested in S P P
2. Cocaine inactivates the peripheral neural receptors responsible for initiating the stapedius reflex Pain such as caused by stapedius paralysis when its contraction i called for, may probably not appear under a condition such as not to necessitate the action of the muscle in its capacity as "tutor labyrinthi"

Future investigation may possibly reveal information about the influence of cocaine on the stapedius reflex by direct observation through an open or "optical" window

In the writer's opinion, investigations to this effect seem to be of considerable importance A clear cut understanding of all the factors responsible for the mechanism of S P P is the prerequisite for a possible clinical application of the phonophobia test

Observation of the presence or absence of direct and/or consensual reaction associated with or without phonophobia could provide appropriate information

Disturbed function of the muscle might not necessarily be based on conspicuous neuropathic conditions as in the case of Bell's palsy, but possibly on myopathic changes as demonstrated by Wolff in cases of otosclerosis

Presence of phonophobia should never be neglected but rather be regarded as an alarming signal calling for appropriate precautions Similarly, as paralysis of the orbicularis palpebrarum muscle demands artificial protection of the eyeball, phonophobia demands it for the inner ear

Testing for phonophobia appears advisable to be instituted as a routine procedure in any case of Bell's palsy For the duration of the phenomenon, patients should be advised to use routinely some sort of sound protectors, particularly when exposed to strong acoustic stimuli by professional or circumstantial factors

It might also be justified to introduce the phonophobia test as a part of routine examinations performed by those responsible for the welfare of industrial workers and employees, and probably also by those working in induction boards of the armed forces

Kato's experiments demonstrating the rapid destruction of the cochlea when it is deprived of its muscular protectors should be kept in mind Informative instructions and protective measurements provided in time might possibly prevent irreversible damage

SUMMARY

Protection of the inner ear as the function of the stapedius muscle appears definitely proved

Its paralysis is frequently associated with Bell's palsy, and manifests itself by hypersensitivity for loud acoustic stimuli at the paralyzed side This phenomenon previously designated by terms such as "hyperacusis" and various other misnomers might more appropriately be called "phonophobia," as suggested by the writer activated by acoustic stimuli It may occur even in deaf people, particularly when produced by sounds close to the border of the hearing field Talking with loud voice into the ear of those patients produces a minor auditory, but a distinct pain sensation "

One may easily conceive that in some of these conditions mentioned by Politzer and Urbantschitsch a latent stapedial dysfunction may possibly play a rôle as a causative factor (Potter[22])

In the writer's opinion such a hypothesis when restricted to the case of otosclerosis appears to be based not merely on speculative grounds In this connection, attention may be called to the microscopical findings in the middle ear muscles as obtained by D Wolff[23] in four cases of otosclerosis In all four cases these muscles appeared to be atrophic

Correlation of the observations mentioned by Politzer and Urbantschitsch with the histological findings of Wolff reveals a new aspect for a potential contribution to the symptomatology of otosclerosis by methodical application of the phonophobia test *

It is self evident that only systematic investigations performed on a large scale of normal and pathological cases of all varieties can determine the value (if any) of this test as a procedure providing probable diagnostic support in cases of questionable otosclerosis

II As a Sign Indicating Diminished Natural Protection of the Inner Ear

A positive phonophobia test might indicate loss or diminution of the action of the stapedius muscle in its capacity as "tutor labyrinthi "

---

*In the writer's opinion Wolff's findings represent also a new concept [illegible] a possible explanation of the still debated mechanism of Hyperacusis Willisii which has been shown to be rather a pseudo hyperacusis

Disturbed function of the muscle might not necessarily be based on conspicuous neuropathic conditions as in the case of Bell's palsy, but possibly on myopathic changes as demonstrated by Wolff in cases of otosclerosis

Presence of phonophobia should never be neglected but rather be regarded as an alarming signal calling for appropriate precautions Similarly, as paralysis of the orbicularis palpebrarum muscle demands artificial protection of the eyeball, phonophobia demands it for the inner ear

Testing for phonophobia appears advisable to be instituted as a routine procedure in any case of Bell's palsy For the duration of the phenomenon, patients should be advised to use routinely some sort of sound protectors, particularly when exposed to strong acoustic stimuli by professional or circumstantial factors

It might also be justified to introduce the phonophobia test as a part of routine examinations performed by those responsible for the welfare of industrial workers and employees, and probably also by those working in induction boards of the armed forces

Kato's experiments demonstrating the rapid destruction of the cochlea when it is deprived of its muscular protectors should be kept in mind Informative instructions and protective measurements provided in time might possibly prevent irreversible damage

SUMMARY

Protection of the inner ear as the function of the stapedius muscle appears definitely proved

Its paralysis is frequently associated with Bell's palsy, and manifests itself by hypersensitivity for loud acoustic stimuli at the paralyzed side This phenomenon previously designated by terms such as "hyperacusis" and various other misnomers might more appropriately be called "phonophobia," as suggested by the writer

A case of unilateral deafness with Bell's palsy and phonophobia on the side of the deaf ear was observed Studies for analysis of this paradoxical phenomenon were performed and some new information obtained about the factors responsible for stapedioparalytic phonophobia

The phenomenon became evident to be controlled by the joint presence of two factors Unimpaired sensitivity of the ipsilateral middle ear structures and unimpaired cochlear function of at least one ear Absence of either one of these two factors abolishes the phenomenon This statement appears supported by the results of studies performed in another case of stapedioparalytic phonophobia with bilateral normal hearing

Conditions in S P P on one hand are compared with those significant for threshold of feeling and for the stapedius reflex on the other hand

Factors possibly responsible for the effect of anesthesia on the stapedius reflex and on S P P. are discussed and plans of investigation are outlined

The possibility of practical applications of the phonophobia test is discussed It might be helpful as a diagnostic support in the symptomatology of otosclerosis

It also might represent a warning signal in cases of latent dysfunction of the stapedius muscle Administration of an artificial inner ear protection in such cases might compensate for the insufficiency of the natural "tutor labyrinthi"

Routine testing for phonophobia appears advisable in any case of Bell's palsy and whenever occupational or circumstantial exposure to potential acoustic traumatization calls for examination of the natural inner ear protectors

BIBLIOGRAPHY

1 Muller J Elements of Physiology p 778 Philadelphia 1843

2 Erhard *Klin Woch* Berlin 51 531 Dec 21 1868

3 Lucae A Die Accomodation und die Accomodationsstoerungen des Ohres *Klin Woch* Berlin Nos 14 16 17 1874

4 Hitzig E. Zur Peripheren Facialislaehmung *Klin Woch.*, Berlin No 2 1869

5 Urbantschitsch V Lehrbuch der Ohrenheilkunde 5th Ed Urban und Schwarzenberg Berlin Wien p 66 1910

6 Kato T Quoted by Schaefer and Giesswein in Denker Kahler Handbuch der Hals-Nasen-Ohrenheilkunde Berlin Muenchen VI 412-415 1926

7 Luescher E. Die Function des Musculus Stapedius beim Menschen *Ztschr f Hals Nasen-Ohrenh.*, 23 105 1939

8 Kobrak, H Beobachtungen des Stapedius Reflexes am Menschen *Ztschr f Hals Nasen Ohrenh* 32 8 1932

9 Kobrak, H Ueber die Klinische Bedautung der Ohrmuskeln. *Ztschr f Hals Nasen-Ohrenh* 31 32 370 1932 1933

10 Kobrak, H Lindsay J, Perlman H and Dubner, H Effect of Limited Cochlear Lesions on Cochlear Potentials and Middle Ear Muscle Reflexes. *Arch Otol*, 27 59 66 Jan 1938

11. Lindsay J Kobrak, H and Perlman H Relation of the Stapedius Reflex to Hearing Sensation in Man. *Arch Otol.*, 23 671 1936

12 Kobrak H Lindsay J and Perlman H Value of the Reflex Contraction of the Muscles of the Middle Ear as an Indicator of Hearing *Arch Otol* 21 663 June 1935

13 Erb, W Ziemssen Cyclopedia of Practice of Medicine 11 490 1876

14 Bazire Case of Facial Paralysis with Impairment of Taste and Acoustic Hyperesthesia on the Same Side as the Paralysis *Brit Med Jour.*, p 249 Sept. 21 1867

15 Brown Sequard Quoted by Bazire

16 Gruenberg V In Denker Kahler Handbuch der Hals Nasen Ohrenh. 6 900 1926

17 Tschiassny K. The Site of the Facial Nerve Lesion in Cases of Ramsay Hunts Syndrome *Ann Otol Rhinol and Laryngol.*, 55 152 Mar., 1946

18 Politzer's Textbook of the Diseases of the Ear by Hilton J Ballin Philadelphia Lea and Febiger 1926

19 Perlman H Hyperacusis *Ann Otol Rhinol and Laryngol* 47 947 1938

20 Lieble, D and Reger, S Threshold of Feeling in the Ear in Relation to Sound Pressures *Arch Otol* 23 653 1936

21 Krassnig M Cocainwirkung auf das Mittel und Innenohr *Ztschr f Hals Nasen-Ohrenh* 31 384 1932

22 Potter, A. Function of the Stapedius Muscle *Ann Otol Rhinol and Laryngol.*, 45 638-643 1936

23 Eggston A. and Wolff D Histopathology of the Ear Nose and Throat. Williams and Wilkins Co 1947

FRANCISCUS SYLVIUS (FRANCOIS DE LE BOE), 1614-1672

Founder of Iatro-Chemistry, a Great Teacher of Medicine, and Rightful Father of the Sylvian Eponyms

Walter A Wells, M D ,
Washington, D C

Due to the fact that there were two great medical men of the past who bore the name of Sylvius, both distinguished in medical history under that name, there is much confusion as to which is intended to be honored by the word "Sylvian" applied to certain well-known anatomical structures

These eponyms being anatomical are naturally of primary interest to the anatomist, but as they pertain to the brain they are of likewise interest to all medical men concerned with this region, especially the otologist, whose work comprises brain surgery

The first Sylvius was Jacques Dubois In English we would call him "Jack Wood," but he translated it into the Latin Jacobus Sylvius to indicate his dignified scholarship in keeping with the custom of the time

His chief fame in medical history is that he was the teacher of the great Vesalius, with whom he entered into a very undignified controversy, calling him "Vesanus" meaning a fool, because he questioned the authority of Galen

The second Sylvius, whom we might designate Sylvanus Secundus, was Francois de le Boe, a native of Hanau, Ger

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 1 1949

FRANCISCUS SYLVIUS

many The family, however, was of French extraction, and the family name in the beginning no doubt was also DuBois, the same as that of the first Sylvius

It was, therefore, natural that on becoming a scholar he also should assume the same Latin name and so he became Franciscus Sylvius

The first Sylvius flourished in the sixteenth century, the second in the seventeenth Time enough has elapsed to enable commentators to establish the authorship of either or both, but reference to modern medical dictionaries and histories

JACOB SYLVIUS

will reveal that uncertainty and confusion as to the Sylvian eponyms still persist The predominant opinion is they are so-named in honor of Jacobus, the first Sylvius

That the credit has not been properly given to Franciscus, to whom as we shall show it certainly belongs, is no doubt due to the fact that being anatomical terms, they were on the one hand naturally attributed to the first Sylvius who was a well known anatomist, while on the other hand, the second Sylvius was so well known as the founder of a new system of medicine, called iatro-chemistry, that his early anatomical studies were completely overshadowed and forgotten

The Sylvian eponyms are as follows

Sylvian aqueduct, a passage which connects the third and fourth ventricles of the brain, aqueductus cerebri

Sylvian fissure, a deep narrow sulcus or depression, which divides the anterior and middle lobes of the brain on each side, fissura cerebri lateralis

Sylvian fossa, a depression on the cerebral hemispheres, situated between the arms of the Sylvian fissure, it marks the location of the important island of Reil, fossa cerebri lateralis

Sylvian line, a line on the surface of the skull which indicates the position of the Sylvian fissure

Sylvian point, the point of the Sylvian fissure marking the division into the anterior, ascendry and posterior limbs, also a corresponding point on the surface of the skull

Sylvian tract, the region of the brain about the Sylvian fissure

Sylvian vein, a vein which runs along the Sylvian fissure and crosses the hemisphere of the brain, vena cerebri media

Sylvian ventricle, the fifth ventricle of the brain, cavum septi pellucida

As well as we can learn the first description of what has widely become known as the Sylvian fissure appeared in a book entitled "Innstitutiones Anatomicae" by Kaspar Bartholin, published at Leyden in 1641

Kaspar Bartholin was the first of a Danish family famous as anatomists This work was not published during his lifetime but under the editorship of his son Thomas several years after his death

Thomas at the time he was called on to bring out this work was a young man of 23, who had not yet taken up the profession of medicine

Realizing that he was not sufficiently equipped for the task, he called to his assistance his friend Francois de le Boe, two years his senior and a recent graduate of medicine at the University of Basle

Francois at this time was occupied almost solely with the science of anatomy and was giving lectures to students on the subject His special interest was anatomy of the brain in which he was studying in a practical manner by painstaking dissections

Included in the work is a bracketed contribution describing the anatomical configuration of the brain signed F S — which initials the editor identifies as referring to Franciscus Sylvius

In 1668 there appeared in London an English translation of this Latin volume under the title "Bartholin's Anatomy from the precepts of his father and the observations of all modern anatomists together with our own," etc

In this edition Thomas Bartholin writes "The windings of the brain I first learned from Franciscus Sylvius" and then goes on to give a description of them, in language which practically duplicated the bracketed contribution signed F S, in the original work — as above mentioned

In his own book, entitled "Disputationes Medicarum" published in 1663, Sylvius has given us the following description of the fissure

"The whole surface of the cerebrum is everywhere quite deeply marked by gyri, similar to the convolutions of the small intestine and *especially by a notable fissure* or hiatus beginning at the root of the eyes (optic tracts), passing backward along the temple above, not further than the roots of the medulla (crura cerebri) and dividing the cerebrum on either hand, with an upper much larger part and a lower smaller one, which gyri ocurring the whole length and depth of the fissure — I may even say with the beginnings of lesser gyri at the very upper ends of the root"

How soon and to what extent the fissure came to be called Sylvian in honor of Franciscus we do not know, but certainly to some extent in the year 1774 when Haller in his "Bibliotheca Anatomica" wrote "Franciscus de le Boe described the *fissure which bears the name of its discoverer*"

Other parts contiguous and related to the fissure came as a natural development thereafter to be called Sylvian, even though this author may not have originally described them

We have a clear cut instance of this in the naming of the Sylvian artery by Vicq d' Azyr in his "Planche Anatomique," Paris, 1786, Vol III

On page 57 he writes referring to the artery, "Its volume is a little more than that of the anterior branch I have given to it the name Sylvian artery because it runs into the fossa of that name The Sylvian artery divides usually into three principal branches of which the middle is placed in the bottom of the fissure that *Sylvius de le Boe has described*"

We believe that the above cannot be considered other than conclusive documentary evidence that to Franciscus Sylvius belongs the honor of having first described the Sylvian fissure and incidentally of fathering the other Sylvian eponyms closely related thereto

Some question might be raised as to the so-called Sylvian aqueduct on the ground that this particular structure had been previously mentioned by the earlier Sylvius

It is true that Jacobus noted the fact that a small canal exists in the brain connecting the third and fourth ventricles, but the observation was not original with him It had been previously observed by others, among them Arantuius Berengarius, Oribasius and even by Galen, furthermore, the term aqueduct was never used by Jacobus (See Dr Frank Baker's excellent paper entitled "The Two Sylviuses," *Johns Hopkins Hospital Bulletin,* 1909, XX, 331)

We trust that our stand in favor of Franciscus Sylvius in the matter of the eponyms will not be misinterpreted as a disparagement of the merits of Jacobus, especially as the latter has suffered already more than he has deserved from the hands of medical historians This is due to the bad light in which that sturdy old sixteenth century anatomist stands as the uncompromising champion of Galenism

Unfortunately for himself, but fortunately for medicine, he had a famous pupil who opposed him

Vesalius had the courage to be one of the first to challenge the infallibility of Galen and the genius to prove his case As a result he became the great hero in medical history the Ajax who defied the lightning or the Prometheus who stole fire from the heaven and brought it down to earth for man's use, therefore, those who were opposed to him have been discredited and maligned

In the acrimonious controversy which ensued between pupil and his former teacher, the latter sometimes went to a ridiculous extreme, as for example when it was plainly shown to him that Galen had wrongly described certain anatomical parts, he replied that Galen was right and man had changed since his time

On the other hand, Vesalius was unfair, unjust, and when he asserted that Sylvius could not know human anatomy, because he never dissected the human body, he was apparently downright untruthful

Commentators generally have repeated the statement of Vesalius, but evidence to the contrary appears in quotation which Dr Baker has supplied us from the writings of Jacobus "You would do well to dissect the bodies of those who have died of some disease in order that by recognizing the cause of the malady you may treat others wisely Do not dissect only bodies of men but also those of monkeys and other animals similar to man Yet I will recommend at first that you work only upon human bodies, thus you will obtain a profound knowledge of the different parts which you can apply in dissecting other animals

"Now many do not like at first to view the dissection of men, and cannot endure it without great disturbance of mind Notwithstanding this, they ought if they can to accustom themselves from the very beginning to look diligently at the body of man as it is being dissected and then to perform the dissection with their own hands"

If Jacobus Sylvius was such a poor teacher as Vesalius would have us believe, it is strange that he should have remained for two years as one of his pupils Another famous pupil who apparently appreciated him was the great Servetus, the man who by his discovery of the lesser circulation anticipated Dr Harvey

Jacobus came of such a poor family they were not able to afford much for his education

He began teaching in Paris before he had received his medical degree, but he had in a short time such a great following of students that the regents of the University of Paris took steps to prevent his holding class

When this happened, out of his savings he went to the University of Montpelier and received a degree there at the age of 53 He then returned to Paris and became professor of Anatomy at the University of Treguier

Here pupils flocked to him from all over Europe and his classes are said to have reached as high sometimes as 500

So much for Sylvius Primus Let us now return to the particular subject of this sketch, Sylvius Secundus — or as he is generally called, Franciscus Sylvius

Francois de le Boe came of a French Huguenot family which fled France to escape persecution

His grandfather, the emigre, had a son Isaac who married Anne de la Vignette of a good French family of Cambria Of this marriage came Francois who when he was old enough was sent to school in Sedan, a French provincial town where the Huguenots were tolerated

The family were in good circumstances and his education was accordingly broad and thorough

After a course of study in which chief attention was centered on physics, botany, and zoology he set on a tour of travel considered in those days as indispensable to the complete education of a young gentleman

He spent sometime in Paris and other seats of learning, including Basle, Switzerland

Here he enrolled at the University for a course in medicine and graduated in 1637, at the age of 23

He continued in residence in Basle for the following year or so and might have remained longer, but his father desired him to return and set up for practice at his home town of Hanau

In a short time, however, he again felt the urge to seek an atmosphere of learning, and he decided to go to Leyden This Dutch city had been growing considerably in importance as a medical center, especially for the teaching of anatomy

This was for two reasons one, that most of the Italian schools had imposed restrictions which excluded non-Catholics, the other, that Holland was more liberal than neighboring countries in the matter of human body dissection

At Leyden, Sylvius entered enthusiastically in the study of anatomy and, as we have noted, made in the very beginning of his career observations that stamp him as one of the seventeenth century pioneers in that science

Young de le Boe liked research work and he no doubt was flattered to be called by a member of the Bartholin family to assist in publishing the works of the great Kaspar, however, his family and friends urged him to engage in private practice, and the best place for that according to all accounts was the thriving metropolis of Amsterdam, which was at the same time a great center for men interested in science and philosophy, as well as medicine

His success as a practitioner was immediate and very great, in fact, he is said to have taken the city as it were by storm Not only was it at once apparent that he was a young man of wide information and extraordinary intelligence, but also that he had an engaging personality He was of strikingly handsome face and figure, with a frank, sincere expression and pleasing manners

He became the most sought after practitioner of the city, and his consultation rooms became the gathering place of the wealthy, the fashionable and the learned, but his popularity was not with these alone he was equally popular with the poor and the less favored, for his sympathy for the sick extended to all classes, and to those too poor to pay he gave his services free Then, as today, it is usually the man who has the most to do who will some way find time to do more, and Sylvius, notwithstanding the insistent demands of a flourishing private practice, managed to find extra time to devote to the fundamental problems of medicine

Ever since his student days at Basle he had been much interested in some aspects of the doctrine propounded by the Belgian philospher-physician, Jean Baptiste von Helmont

This doctrine was a strange mixture of sound scientific principles and weird, meaningless mysticism

Von Helmont was an asute observer and a careful experimenter, but he was also a firm believer in alchemy, astrology and other vagaries

He believed all the processes of the living bodies were the direct result of fermentation due to chemical action, and that these changes could be brought about only through the influence of a certain subtle spirit which he called "archeus" or "blas"

There was a special archeus for each separate organ, and a general overseeing (archeus influx) for the whole body

The seat of the soul (anima sensitiva), he located in the pit of the stomach

Sylvius adopted the idea of fermentation as the important phenomenon of body change, but he rejected the idea of the archeus as implementing agent

He believed that the chemical processes of the living body were no different from those in inanimate matter and he proceeded to concoct a scheme for treating disease based on the chemistry of the laboratory

Sylvius must have seen much of another resident of Amsterdam who was likewise engaged in the study of the fundamentals of the living body, and who is regarded as one of the founder of a new system of medical treatment

Descartes had come from France to live in Amsterdam as a voluntary exile and continued to reside there the remainder of his life Although not a physician, he considered the study of the working of the living body as an important branch of his philosophy He practiced dissection wrote a work on physiology and was much quoted by the adherents to that school of medical practice known as Iatro-physics It would have been better, however, if he had confined himself to pure philosophy and left medicine to those better versed in that subject

He opposed Harvey's theory of the circulation and held that the heart was merely the source of the body heat Among other errors which he propagated was the idea that the nerves were hollow and conveyed a juice (succus nerveus) which was responsible for motion and sensation Differing from Von Helmont, he placed the seat of the soul in the little pea sized organ of the brain known as pineal gland

On the other hand, his philosophy is profound, and his work on the subject of optics was of the highest value and laid the true foundation of that science

In 1658, Sylvius was called to assume the chair of medicine at the University of Leyden

He hesitated a long while before leaving, and when he finally decided to accept, his departure from Amsterdam was a cause of gloom and regret throughout the city

While this was an over-simplification of the complexities of body chemistry, it, nevertheless, was useful in turning medical thought away from the old humoral doctrine and into a path which was to lead eventually to a fruitful field of research

He devoted much attention to the physiology of digestion, and recognized in the secretion of saliva an important factor in the first stage of this process, it was seen as giving rise to a fermentation, producing the first change in the food, to be followed by other fermentations brought about by the bile and the pancreatic juices

He followed up Stensen's discovery of the parotid duct in sheep by demonstrating its presence in man

He recognized the fact that while some glands had ducts, there were others which were ductless, and he employed the terms conglobate and conglomerate to distinguish between two types of glands, which later came to be designated as simple and compound

There is also to his credit two original observations in the domain of neurology

He was the first to differentiate between thermal and tactile sensation, and he was the first to make a distinction between continuous muscular tremor and that which was initiated by voluntary movement (the so-called intentional tremor)

In the line of pathology he made an outstanding contribution — one which alone should entitle him to a high place in the annals of medical achievement it was he who first described the tubercles of the lung He observed their progress into the formation of cavities and he grasped their relationship with the disease then called phthisis

He wrote "I more than once found large and small tubercles which on section were found to contain pus I believe that these tubercles became purulent and are changed into cavities which are lined with their membranes In these tubercles I hold that not infrequently phthisis has its origin"

In Sylvius' day very little scientific attention was given to diseases of children These were for the most part discussed only in pamphlets gotten out by charlatans for the exploitation of the laity In "De morbus infantum" published in Amsterdam, 1674, Franciscus Sylvius made one of the first attempts to present what might be called scientific consideration of the subject

A few years later there appeared in London an English translation of the treatise, which unfortunately was not altogether free of some commercial coloring

Sylvius recognized better than most men of his time the delicate nature of a young child's constitution, and he advised against drastic drugging then much employed and recommended instead the use of very mild remedies He especially favored the volatile spirits He suggested the use of aromatics for whooping cough Incidentally, he was opposed to excessive bleeding in all cases, adults as well as children

Sylvius was early among the great authorities to recognize the significance of the theory of the circulation of the blood as propounded by Harvey

He made experiments on his own account which tended to confirm it, and it was largely through his influence that it was accepted in Holland sooner than in other European countries

Perhaps that for which more than anything else he deserves the plaudits of posterity was his pioneering in clinical instruction

During the Hippocratic era it had been a custom for some physicians who were teachers to take a group of students on their rounds to see patients

Some of these patients have revealed this fact in telling us how even worse than the illness was the thumping and mauling they received at the hands of the young medical greenhorns who followed at their doctor's heels

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave North Nashville 3 Tenn

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg Atlanta 3, Ga

Vice Chairman Dr V R Hurst, 315 N Center St, Longview, Tex

Secretary Dr Alston Callahan, 908 S Twentieth St, Birmingham 5 Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St, Philadelphia Pa

Vice President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore Pa

Treasurer Dr Harry P Schenck, 1912 Spruce St., Philadelphia, Pa

Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa.

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Reinaldo de Villiers

Vicepresidente Dr César Cabrera Calderin

Secretario Dr José Xirau

Tesorero Dr Alfredo M Petit

Vocal Dr José Gross

Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier

First Secretary Dr Gabriel Porto

Second Secretary Dr Roberto Barbosa.

Librarian Treasurer Dr Leoncio de Souza Queiroz

Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino

Vice-Presidente Dr Luis E Olsen

Secretario Dr Eugenio Romero Díaz

Tesorero Dr Juan Manuel Pradales

Vocales Dr Osvaldo Suárez, Dr Nondier Asís R. Dr Jorge Bergallo Yofre

THE
LARYNGOSCOPE.

VOL. LIX SEPTEMBER, 1949 NO 9

RHINOLOGY IN CHILDREN, RESUME OF AND COMMENTS ON THE LITERATURE FOR 1948

D E S WISHART, M D ,
Toronto, Canada

The outstanding event of the year under review is the commencement of the experiment of medicine as a planned economy in Great Britain In America forces are working toward a similar experiment The paucity of articles on rhinology in children from across the Atlantic is extreme, is this one of the unforeseen effects of the new scheme? In America, there is very little in the special journals to show that thought is being given as to what the effect of the impact of the arrangement will be on our specialty

The articles strictly limited to our subject in our own journals are none too many Some leave the impression that the scientific quality of medical practice is in some way dependent on the part played by the laboratory Some show too great a reliance on technique Some show a reverence for a large bibliography A deficiency of critical attitude is general On the whole, your reviewer is struck by a lack of evidence of intellectual effort To offset these impairments, articles closely related to our subject have been included, and wherever pos-

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication Aug 1 1949

While this was an over-simplification of the complexities of body chemistry, it, nevertheless, was useful in turning medical thought away from the old humoral doctrine and into a path which was to lead eventually to a fruitful field of research

He devoted much attention to the physiology of digestion, and recognized in the secretion of saliva an important factor in the first stage of this process, it was seen as giving rise to a fermentation, producing the first change in the food, to be followed by other fermentations brought about by the bile and the pancreatic juices

He followed up Stensen's discovery of the parotid duct in sheep by demonstrating its presence in man

He recognized the fact that while some glands had ducts, there were others which were ductless, and he employed the terms conglobate and conglomerate to distinguish between two types of glands, which later came to be designated as simple and compound

There is also to his credit two original observations in the domain of neurology

He was the first to differentiate between thermal and tactile sensation, and he was the first to make a distinction between continuous muscular tremor and that which was initiated by voluntary movement (the so-called intentional tremor)

In the line of pathology he made an outstanding contribution — one which alone should entitle him to a high place in the annals of medical achievement it was he who first described the tubercles of the lung He observed their progress into the formation of cavities and he grasped their relationship with the disease then called phthisis

He wrote "I more than once found large and small tubercles which on section were found to contain pus I believe that these tubercles became purulent and are changed into cavities which are lined with their membranes In these tubercles I hold that not infrequently phthisis has its origin"

In Sylvius' day very little scientific attention was given to diseases of children These were for the most part discussed only in pamphlets gotten out by charlatans for the exploitation of the laity In "De morbus infantum" published in Amsterdam, 1674, Franciscus Sylvius made one of the first attempts to present what might be called scientific consideration of the subject

A few years later there appeared in London an English translation of the treatise, which unfortunately was not altogether free of some commercial coloring

Sylvius recognized better than most men of his time the delicate nature of a young child's constitution, and he advised against drastic drugging then much employed and recommended instead the use of very mild remedies He especially favored the volatile spirits He suggested the use of aromatics for whooping cough Incidentally, he was opposed to excessive bleeding in all cases, adults as well as children

Sylvius was early among the great authorities to recognize the significance of the theory of the circulation of the blood as propounded by Harvey

He made experiments on his own account which tended to confirm it, and it was largely through his influence that it was accepted in Holland sooner than in other European countries

Perhaps that for which more than anything else he deserves the plaudits of posterity was his pioneering in clinical instruction

During the Hippocratic era it had been a custom for some physicians who were teachers to take a group of students on their rounds to see patients

Some of these patients have revealed this fact in telling us how even worse than the illness was the thumping and mauling they received at the hands of the young medical greenhorns who followed at their doctor's heels

Bedside teaching, however, went out of fashion and for many centuries only didactic methods prevailed

There had come of late a slight revival of the clinical approach in some of the Italian universities

It received no encouragement, however, in the severe scholastic regime of either France or England

Sylvius was the first to introduce it anywhere north of the Alps

It was a modest beginning — a small infirmary of a dozen or so beds — but was a very important one Leyden was beginning to enjoy under Sylvius a kind of fame which reached its zenith under his successor, Boerhaave, who, continuing and enlarging this practice, made it the leading center for clinical instruction of all Europe

Writing in 1664, Sylvius said "I have led my pupils by the hand to medical practice, employing a method unknown at Leyden or perhaps anywhere else, that is, taking them daily to visit the sick in public hospital There I have put the symptoms of disease before their eyes, have let them then hear the complaints of the patient and have asked their opinion as to the cause and rational treatment of each case and the reasons for their opinion Then I have given them my own judgment on every point Together with me they have seen the happy results of treatment when God has granted to our cases a restoration of health or they have assisted in examining the body when the patient has paid the inevitable tribute to death"

An admiring contemporary Schact has thus described his methods

"When he came with his pupils to the patient and began to teach he appeared completely in the dark as to the cause or nature of the affection the patient was suffering from and at first expressed no opinion of the case

"He then began by questions put to different members of his audience to fish out everything and finally united the facts, discovering in this manner a complete picture of the disease in such way that the students received the impression that they themselves had made the diagnosis and not learned it from him"

To what position in the history of medicine shall Franciscus Sylvius be assigned?

Sir Michael Foster in his classical work, "Lectures on the History of Physiology," has expressed the opinion that he was to be considered as a very able expositor of the facts, but not a great reasoner

Exception may well be taken, however, to this opinion of Foster on the ground that he was not altogether a competent judge

What better proof of this than his statement that it was not Franciscus but his predecessor Jacobus who deserves the honor of being regarded as the discoverer of the Sylvian fissure?

Franciscus did, as we have pointed out, make worthwhile original observations in anatomy, chemistry, physiology, pathology and therapeutics

His views, of course, in the light of modern knowledge were not in all points perfect, but they were generally ahead of his day, and in some respects remarkably progressive and modern

It is especially noteworthy that when defective they were leading in the right direction

In chemistry his ideas of alkalis and acid led to the introduction of many valuable mineral salts, in physiology his idea of the rôle of fermentation in the process of digestion led to the discovery of important enzymes

Especially do we stress the fact that the early studies in anatomy made by Franciscus Sylvius have generally been overlooked

Certainly, true justice cannot be done his reputation unless he be given the credit he so clearly deserves of being recognized as the legitimate father of the famous Sylvian anatomical eponyms

Bedside teaching, however, went out of fashion and for many centuries only didactic methods prevailed

There had come of late a slight revival of the clinical approach in some of the Italian universities

It received no encouragement, however, in the severe scholastic regime of either France or England

Sylvius was the first to introduce it anywhere north of the Alps

It was a modest beginning — a small infirmary of a dozen or so beds — but was a very important one Leyden was beginning to enjoy under Sylvius a kind of fame which reached its zenith under his successor, Boerhaave, who, continuing and enlarging this practice, made it the leading center for clinical instruction of all Europe

Writing in 1664, Sylvius said "I have led my pupils by the hand to medical practice, employing a method unknown at Leyden or perhaps anywhere else, that is, taking them daily to visit the sick in public hospital There I have put the symptoms of disease before their eyes, have let them then hear the complaints of the patient and have asked their opinion as to the cause and rational treatment of each case and the reasons for their opinion Then I have given them my own judgment on every point Together with me they have seen the happy results of treatment when God has granted to our cases a restoration of health or they have assisted in examining the body when the patient has paid the inevitable tribute to death"

An admiring contemporary Schact has thus described his methods

"When he came with his pupils to the patient and began to teach he appeared completely in the dark as to the cause or nature of the affection the patient was suffering from and at first expressed no opinion of the case

"He then began by questions put to different members of his audience to fish out everything and finally united the facts, discovering in this manner a complete picture of the disease n such way that the students received the impression that hey themselves had made the diagnosis and not learned it rom him ”

To what position in the history of medicine shall Franciscus ylvius be assigned?

Sir Michael Foster in his classical work, “Lectures on the History of Physiology,” has expressed the opinion that he was to be considered as a very able expositor of the facts, but not a great reasoner

Exception may well be taken, however, to this opinion of Foster on the ground that he was not altogether a competent judge

What better proof of this than his statement that it was not Franciscus but his predecessor Jacobus who deserves the honor of being regarded as the discoverer of the Sylvian fissure?

Franciscus did, as we have pointed out, make worthwhile original observations in anatomy, chemistry, physiology, pathology and therapeutics

His views, of course, in the light of modern knowledge were not in all points perfect, but they were generally ahead of his day, and in some respects remarkably progressive and modern

It is especially noteworthy that when defective they were leading in the right direction

In chemistry his ideas of alkalis and acid led to the introduction of many valuable mineral salts, in physiology his idea of the rôle of fermentation in the process of digestion led to the discovery of important enzymes

Especially do we stress the fact that the early studies in anatomy made by Franciscus Sylvius have generally been overlooked

Certainly, true justice cannot be done his reputation unless he be given the credit he so clearly deserves of being recognized as the legitimate father of the famous Sylvian anatomical eponyms

JOINT MEETING SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY AND NORTH CAROLINA EYE, EAR, NOSE AND THROAT SOCIETY

The joint meeting of the South Carolina Society of Ophthalmology and Otolaryngology and the North Carolina Eye, Ear, Nose and Throat Society will be held at Hotel Poinsett, Greenville, S C, Sept 12 through Sept 15 The following program will be presented

Dr A D Ruedemann, professor of ophthalmology, Wayne University, Detroit, Mich

1 The Differential Diagnosis Between Unilateral and Bilateral Ocular Protrusion

2 The End-Results with New Radium-D Applicator in Comparison to Radon

3 Ocular Manifestations of Allergy

Dr Peter C Kronfeld, department of ophthalmology, Illinois Eye and Ear Infirmary, University of Illinois, Chicago, Ill

1 Differential Diagnosis of Acute Glaucoma

2 Prognosis of Retinal Detachment

3 Newer Drugs in Ophthalmology

Dr Rudolph Aebli, professor of ophthalmology, New York University, Bellevue Medical Center, Post-Graduate Medical School, New York, N Y

1 The Relationship of Muscle Imbalances to the Palpebral Aperture and Pseudo-Ptosis

2 Principles of Ocular Muscle Surgery

3 Congenital Muscle Anomalies

Dr Carl C Johnson, associate, department of ophthalmology, Harvard University, Boston, Mass

1 Surgical Treatment of Ptosis

2-3 The Diagnosis and Surgical Treatment of Glaucoma

Dr Preston C Iverson, New York, N Y

1 Neoplasms of the Lip, Nose and Eyelid and Plastic Repair of the Lesions

2 Congenital Deformities of the Face

Dr Louis H Clerf, Philadelphia, Pa

1 Cough Viewed from Otolaryngologic Standpoint

2 Paralysis of Larynx Surgical Treatment

3 Malignant Neoplasms of Larynx

Dr Kenneth M Day, Pittsburgh, Pa

1 Clinical Management of Deafness

2 Ménière's Disease

Dr Russell A Sage, Indianapolis, Ind

1 Diseases of the Mouth and Tongue

South Carolina Society of Ophthalmology and Otolaryngology President, Dr Pierre G Jenkins, Vice-President, Dr Murdock Walker, Secretary-Treasurer, Dr Roderick Macdonald

North Carolina Eye, Ear, Nose and Throat Society President, Dr James Harrill, Vice-President, Dr G M Billings, Secretary-Treasurer, Dr MacLean B Leath

For further information, address Dr Roderick Macdonald, Secretary, South Carolina Society of Ophthalmology and Otolaryngology, Rock Hill, S C, or Dr MacLean B Leath, Secretary, North Carolina Eye, Ear, Nose and Throat Society

SECOND PAN AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY — MONTEVIDEO-BUENOS AIRES, JAN 8-15, 1950

EXECUTIVE COMMITTEE

President Prof Justo M Alonso

Vice-Presidents Prof Elias Regules, Dr Juan Carlos Munyo, Prof Juan Carlos Oreggia

Secretary General Prof Pedro Regules

Secretary of Interior Prof Hector Rebagliatti

Secretary of Exterior Dr Julio Cesar Barani

Secretary of Exhibit Dr Enrique Apolo

Secretary of Publicity Dr Jaime Sala Lopez

Treasurer Dr Alberto Santoro Vecino

Assistant Treasurer Dr Juan Carlos Munyo, Jr

Delegate in Argentine Republic Prof Juan Manuel Tato

Delegate in Mexico Dr Ricardo Tapia Acuña

Delegate in Cuba Dr Pedro Hernandez Gonzalo

Delegate in the U S A and Canada Dr Chevalier L Jackson

An interesting and instructive program has been arranged

Subscription—$10, or its equivalent in Uruguayan money

The following week (Jan 16-21) there will take place in Montevideo and Buenos Aires, operative demonstrations for those who wish to attend

Travel arrangements should be made immediately through Thomas Cook & Sons or Pan American Airways

All those interested in attending this Congress should communicate at once with the delegate in the U S A and Canada, Dr Chevalier L Jackson, 3401 North Broad Street, Philadelphia 40, Pa

JULY 1, 1949

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp, 580 Fifth Ave New York 19, N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St. Chicago Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac, Beltone Symphonette

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St. Chicago Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co, Inc. 10 East 43rd St., New York 17 N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc, 50 W 29th St. New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co Inc, North Third St., Minneapolis, Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp, 1 W 34th St. New York, N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co, 727 Atlantic Ave Boston 11, Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co, 4602 Nicollet Ave, Minneapolis 9 Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories 815 S Hill St Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4

Manufacturer Otarion Hearing Aids, 159 N Dearborn St, Chicago Ill

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)

Manufacturer Paraphone Hearing Aid, Inc 2056 E 4th St., Cleveland Ohio

Precision Table Hearing Aid

Manufacturer Precision Electronics Co, 850 W Oakdale Chicago 14 Ill

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone, Radioear Permo-Magnetic Multipower—report not yet published

Manufacturer E A Myers & Sons 306 Beverly Rd Mt. Lebanon Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp, 6001 W Dickens Ave Chicago Ill.

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp, 101 Tremont St Boston 8 Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc 2454 S Michigan Ave Chicago Ill

Televox Model E

Manufacturer Televox Mfg Co 117 S Broad St Philadelphia 7, Pa

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550

Manufacturer Telex Inc Minneapolis 1 Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc. 1627 Pacific Ave, Dallas 1 Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm Inc 400 W Lake St. Libertyville Ill

Unex Model "A", Unex Midget Model 95, Unex Midget Model 110

Manufacturer Nichols & Clark, Hathorne Mass

Vacolite Model J

Manufacturer Vacolite Co 3003 N Henderson St. Dallas 6 Tex.

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc. 120 Broadway New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave Chicago Ill

All of the accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer, 20 Charlesgate, West Boston 15, Mass
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3 N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A Fenton, 906 Medical Arts Bldg, Portland, Ore
Secretary Louis H Clerf, 1530 Locust St., Philadelphia 2, Pa
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin, 384 Post St, San Francisco 8, Calif
Secretary Dr C Stewart Nash, 708 Medical Arts Building, Rochester, N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

Eastern Section, Hotel Statler, New York, N Y, Jan 5, 1950
Council Meeting, Hotel Statler, New York City, Jan 6, 1950
Combined Meeting Southern and Middle Sections, Peabody Hotel, Memphis, Tenn, Jan 16 17, 1950
Western Section, Medical Society Bulding, Los Angeles, Calif, Jan 21 22, 1950

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St., Charlottesville, Va.
Secretary Dr James M Robb, 641 David Whitney Bldg Detroit, Mich.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens, 35 E 70th St, New York N Y
President Elect Dr J Mackenzie Brown, 1136 W 6th St., Los Angeles, Calif
Executive Secretary Dr William L Benedict Mayo Clinic, Rochester Minn
Meeting Palmer House, Chicago Ill, Oct 9 14, 1949

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley 384 Post St. San Francisco, Calif

Secretary Treasurer Dr Joseph Hampsey, 806 May Bldg Pittsburgh 22 Pa.

PAN AMERICAN ASSOCIATION OF OTO-RHINO LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof. Justo Alonso

Secretary Dr Chevalier L. Jackson 255 S 17th St. Philadelphia Pa.

Second Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology Montevideo, January 1950

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President Dr LeRoy A. Schall 243 Charles St. Boston Mass

Secretary Dr Edwin N Broyles, 1100 N Charles St. Baltimore 1 Md

Meeting Mark Hopkins Hotel San Francisco Calif May 1950

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Warren A. Wilson.

Secretary Treasurer Dr Victor Goodhill.

Chairman of Section on Ophthalmology Dr George Landegger

Secretary of Section on Ophthalmology Dr Harold B Alexander

Chairman of Section on Otolaryngology Dr Alden H. Miller

Secretary of Section on Otolaryngology Dr Leland R. House

Place Los Angeles County Medical Association Bldg 1925 Wilshire Blvd., Los Angeles Calif.

Time 6 P.M., fourth Monday of each month from September to May inclusive.

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner 115 E. 61st Street, New York 21 N Y

Secretary Dr Norman N Smith, 291 Whitney Avenue New Haven 11 Conn.

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Garnett P Morison Charles Town W V

First Vice-President Dr Charles T St. Clair Jr Bluefield W Va.

Second Vice-President Dr Arthur C Chandler Charleston, W Va.

Secretary Dr Melvin W McGehee 425 Eleventh St. Huntington 1, W Va.

Treasurer Dr Frederick C Reel Charleston W Va

Directors Dr Eugene C Hartman Parkersburg W Va. Dr Ivan Fawcett, Wheeling W Va.

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer, 20 Charlesgate, West Boston 15 Mass
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3 N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A Fenton, 906 Medical Arts Bldg, Portland Ore
Secretary *Louis H Clerf*, 1530 Locust St, Philadelphia 2, Pa
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin, 384 Post St, San Francisco 8, Calif
Secretary Dr C Stewart Nash, 708 Medical Arts Building, Rochester, N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

Eastern Section, Hotel Statler, New York, N Y, Jan 5, 1950
Council Meeting, Hotel Statler, New York City, Jan 6, 1950
Combined Meeting, Southern and Middle Sections, Peabody Hotel Memphis, Tenn, Jan 16 17, 1950
Western Section, Medical Society Bulding, Los Angeles, Calif, Jan 21 22, 1950

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St., Charlottesville, Va.
Secretary *Dr James M Robb*, 641 David Whitney Bldg, Detroit, Mich.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens, 35 E 70th St, New York, N Y
President Elect Dr J Mackenzie Brown, 1136 W 6th St., Los Angeles, Calif
Executive *Secretary* Dr William L Benedict, Mayo Clinic, Rochester Minn
Meeting Palmer House Chicago, Ill, Oct 9 14, 1949

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley 384 Post St., San Francisco Calif

Secretary Treasurer Dr Joseph Hampsey 806 May Bldg Pittsburgh 22 Pa.

PAN AMERICAN ASSOCIATION OF OTO-RHINO-LARYNGOLOGY AND BRONCHO-ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L. Jackson, 255 S 17th St. Philadelphia Pa.

Second Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology Montevideo January 1950

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President Dr LeRoy A. Schall 243 Charles St. Boston Mass

Secretary Dr Edwin N Broyles 1100 N Charles St., Baltimore 1 Md

Meeting Mark Hopkins Hotel, San Francisco, Calif May 1950

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President· Dr Warren A. Wilson.

Secretary Treasurer Dr Victor Goodhill.

Chairman of Section on Ophthalmology Dr George Landegger

Secretary of Section on Ophthalmology Dr Harold B Alexander

Chairman of Section on Otolaryngology Dr Alden H. Miller

Secretary of Section on Otolaryngology Dr Leland R. House

Place Los Angeles County Medical Association Bldg, 1925 Wilshire Blvd. Los Angeles Calif

Time 6 P.M., fourth Monday of each month from September to May inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner 115 E. 61st Street, New York 21 N Y

Secretary Dr Norman N Smith, 291 Whitney Avenue New Haven 11 Conn.

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Garnett P Morison, Charles Town, W V

First Vice-President Dr Charles T St. Clair, Jr Bluefield W Va.

Second Vice-President Dr Arthur C Chandler Charleston, W Va.

Secretary Dr Melvin W McGehee 425 Eleventh St. Huntington 1 W Va.

Treasurer Dr Frederick C Reel Charleston W Va

Directors Dr Eugene C Hartman, Parkersburg W Va. Dr Ivan Fawcett, Wheeling W Va.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave North Nashville 3 Tenn
Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg Atlanta 3, Ga
Vice Chairman Dr V R Hurst, 315 N Center St, Longview, Tex
Secretary Dr Alston Callahan, 908 S Twentieth St, Birmingham 5 Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St, Philadelphia Pa
Vice President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore, Pa
Treasurer Dr Harry P Schenck, 1912 Spruce St., Philadelphia, Pa
Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Reinaldo de Villiers
Vicepresidente Dr César Cabrera Calderín
Secretario Dr José Xirau
Tesorero Dr Alfredo M Petit
Vocal Dr José Gross
Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa.
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice-Presidente Dr Luis E Olsen
Secretario Dr Eugenio Romero Diaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez, Dr Nondier Asis R Dr Jorge Bergallo Yofre

THE

LARYNGOSCOPE.

Vol LIX SEPTEMBER, 1949 No 9

RHINOLOGY IN CHILDREN, RESUME OF AND COMMENTS ON THE LITERATURE FOR 1948

D E S Wishart, M D,
Toronto, Canada

The outstanding event of the year under review is the commencement of the experiment of medicine as a planned economy in Great Britain In America forces are working toward a similar experiment The paucity of articles on rhinology in children from across the Atlantic is extreme, is this one of the unforeseen effects of the new scheme? In America, there is very little in the special journals to show that thought is being given as to what the effect of the impact of the arrangement will be on our specialty

The articles strictly limited to our subject in our own journals are none too many Some leave the impression that the scientific quality of medical practice is in some way dependent on the part played by the laboratory Some show too great a reliance on technique Some show a reverence for a large bibliography A deficiency of critical attitude is general On the whole, your reviewer is struck by a lack of evidence of intellectual effort To offset these impairments, articles closely related to our subject have been included, and wherever pos-

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication Aug 1, 1949

sible articles showing divergency or disagreement have been placed close together The same journals have been covered as in previous reviews, and the same order of discussion has been followed

GENERAL ARTICLES – HEAD COLDS

In reply to a correspondent[1] who asked if it would be permissible to attempt to reduce the incidence of severe head colds in a child, aged five, in whom no pathological cause can be found in the ears, nose or throat, by giving small daily doses of sulfadiazine throughout the winter, the *British Medical Journal* replied as follows

> The most likely etiological agent of the common cold is a virus, consequently the use of sulfadiazine would not be justified as a prophylactic measure There would seem to be three possible causes for the trouble first, there may be a chronic carrier (*i e*, old sinus trouble) in the family Recurrent upper respiratory tract infection in children is sometimes cured by taking out father's tonsils! Second, the child may have some pathological condition which has been missed, such as antral infection Third, associated with both of these, immunity may be low and might be stimulated by the use of a suitable vaccine and by general measures such as a full vitamin dosage, fresh air and attempts to harden the child The possibility of an allergic rhinitis should not be overlooked

The *British Medical Journal*,[2] in an annotation on oral penicillin in children, states that an important question in connection with penicillin treatment is the extent to which oral administration is justifiable Against the single advantage of convenience must be set its extravagance, the dose required being at least five times greater than that injected, and the grave disadvantage of marked irregularity of absorption All observers who have carefully studied its effects have noted that absorption varied widely from case to case, with the result that in any series of patients some will inevitably absorb only inadequate quantities of a dose which will suffice for others Infants and children are naturally less tolerant of injection and require oral doses on a less extravagant scale Two years ago, Buchanan suggested that infants under six months should absorb penicillin better than older children and adults because of the low HCl content of their gastric juice, and her own observations on 25 babies supported this Satisfactory blood levels were obtained by adding penicillin to foods in amounts equivalent to a daily dose of only 4,000 units per pound (454 gm) of body weight

Various authors have reported favorably on the treatment of acute infections in young children with oral penicillin Two publications on this subject from the United States tend rather to emphasize the limitations of this method than to acclaim its efficiency Reisman and his colleagues treated 22 children, most of whom had upper respiratory tract infections, with large doses of oral penicillin, from 50,000 to 1,000,000 units being given every hour by day and every two hours by night The results were "fair" in 12 patients, in the remaining 10 there was no apparent effect In the majority no penicillin was detected in the blood, which is surprising in view of the amounts given, but this may perhaps be explained by irregular administration Case 4, for instance, receiving "1,000,000 units every hour while awake and every two hours while asleep" for five days, is stated to have had a total dose of only 7,800,000 units — an unexplained discrepancy The patients' ages are not stated, and there are no bacteriological data Possibly some of the infections may have been caused by insusceptible organisms The more valuable part of this paper is a study of absorption after oral administration, this again emphasizes what many previous authors have observed, namely, the importance of an empty stomach if absorption is to be adequate Buffers and tablets were found to have no advantages, a simple solution in water being recommended

A similar study was made by Markowitz and Kuttner They gave a standard oral dose of 50,000 units to children at various times before and after meals, and found that a satisfactory blood level was usually maintained for two hours only when the dose was given after a four-hour fast According to these findings the continuous maintenance of a therapeutic blood level by the oral administration of any reasonable dose must be impossible It may well be concluded that older children should be treated like adults and given penicillin intramuscularly, at least in the first stage of the treatment of any severe infection The form of oral treatment with penicillin which has the best justification is the addition of the drug to the foods of infants in the way suggested by Buchanan

The *Journal of the American Medical Association*[3] states that a few years ago several articles appeared which advocated use of large doses of ascorbic acid in the early stages of acute rhinitis Subsequently little evidence has appeared to support the contention that this therapy has any appreciable effect in aborting or cutting short the attack Personal experience also fails to support the claim Harmful effects have not been reported or experienced by the writer More recently the use of tripelennamine hydrochloride or other antihistaminic drugs has been recommended in the early stages of acute rhinitis on the assumption that vasodilatation responsible for the free flow of nasal secretion could be controlled by these drugs Beneficial effects are reported by a few persons, but controlled statistics are not as yet available

The study reported by Cowan and Diehl[4] was conducted at the request of the Commission on Influenza of the Office of the Surgeon General, United States Army The experimental subjects were students of the University of Minnesota A controlled study indicates that influenza vaccine A and B is of no value for the prevention of the common cold The subjects who received influenza vaccine reported more reactions than the control group

Dukes and Gillespie[5] immunized 100 children with influenza virus vaccine types A and B In the vaccinated group, 42 per cent were between 19 months and six years of age, 50 per cent were between six and 10 years of age, and 8 per cent were between 10 and 16 years of age A group similar in number and age distribution served as controls Immuniza tion consisted of two injections of the vaccine, 0 5 cc at each injection and at intervals of one week Smaller doses were given to 14 children The incidence of influenza in the immunized and control groups was not unlike except for the youngest age group, in which the incidence of influenza was much less frequent in the immunized children The authors were impressed by the frequency of reactions from the injections and the incidence of rather severe reactions in the younger children Perhaps a dosage of vaccine dependent on body weight, as with typhoid vaccine, would reduce the number and severity of reactions Further studies of larger series of children are necessary to evaluate accurately the effectiveness of the vaccine and to determine proper immunizing doses

Brewster[6] used diphenhydramine hydrochloride ("benadryl hydrochloride" N N R) experimentally in the treatment of about 100 cases of the common cold It has been found to completely abort 10 per cent of such cases and to shorten the course and afford subjective relief to the patient in 95 per cent of all cases This is due to its inhibiting effect on the serous discharge from the mucous membrane of the upper part of the respiratory tract and its soporific effect It inhibits the cough reflex, especially in children, probably because it eliminates postnasal drip

COMPLICATIONS OF ACCESSORY SINUS DISEASE

Crowe and Lett[7] state that it is the oft-repeated, acute bacterial infections that eventually lead to chronic suppuration and necessitate radical operations The mucous membrane of the accessory nasal sinuses has a remarkable ability to recover after a single or an occasional infection

They believe that the nasopharynx is a very important portal of entry of the common cold virus, for the first symptoms after experimental inoculation of the nasal passages of chimpanzees or human vounteers with the common cold virus is hyperemia and irritation in the nasopharynx, not in the nose or the pharynx ing to these findings the continuous maintenance of a therapeutic blood level by the oral administration of any reasonable dose must be impossible It may well be concluded that older children should be treated like adults and given penicillin intramuscularly, at least in the first stage of the treatment of any severe infection The form of oral treatment with penicillin which has the best justification is the addition of the drug to the foods of infants in the way suggested by Buchanan

The *Journal of the American Medical Association*[3] states that a few years ago several articles appeared which advocated use of large doses of ascorbic acid in the early stages of acute rhinitis Subsequently little evidence has appeared to support the contention that this therapy has any appreciable effect in aborting or cutting short the attack Personal experience also fails to support the claim Harmful effects have not been reported or experienced by the writer More recently the use of tripelennamine hydrochloride or other antihistaminic drugs has been recommended in the early stages of acute rhinitis on the assumption that vasodilatation responsible for the free flow of nasal secretion could be controlled by these drugs Beneficial effects are reported by a few persons, but controlled statistics are not as yet available

The study reported by Cowan and Diehl[4] was conducted at the request of the Commission on Influenza of the Office of the Surgeon General, United States Army The experimental subjects were students of the University of Minnesota A controlled study indicates that influenza vaccine A and B is of no value for the prevention of the common cold The subjects who received influenza vaccine reported more reactions than the control group

Dukes and Gillespie[5] immunized 100 children with influenza virus vaccine types A and B In the vaccinated group, 12 per cent were between 19 months and six years of age, 50 per cent were between six and 10 years of age, and 8 per cent were between 10 and 16 years of age A group similar in number and age distribution served as controls Immuniza read by those who have to deal with such complications in children The authors show that the diagnostic problems involved are often complicated and that a painstaking, thorough rhinologic investigation is required to avoid unnecessary delay in making an accurate diagnosis and in carrying out adequate therapeutic measures The laryngologist should be the first and not the last consultant in these cases, and for him it will frequently be a problem requiring the most careful observation and study

Glass[9] reports the case record of a patient aged 14, who would undoubtedly have died before the penicillin era but recovered with the use of penicillin The course of a dreadful illness of two and one-half months' hospitalization, during which four operations were performed, is graphically and excellently portrayed and enables a surgeon with such a case on his hands to gain much that can be of assistance to him The patient was last seen 10 months after discharge from hospital He is in perfect health There has been no evidence of residual disability

Johnson[10] reports a survey of the patients entering the ear, nose and throat service of the Los Angeles General Hospital covering a period of 10 years from 1935 to 1945, to determine the incidence of frontal sinusitis During this period, 51,692 patients with diseases of the ear, nose and throat were seen in the outpatient department, of these, 22,513 were hospitalized Sixty-eight of these had frontal sinusitis which required hospitalization

Fifteen of these were children 14 years of age and under The youngest was nine years of age There was only one death, a child of 13 had osteomyelitis, trephination was performed, death occurred from epidural abscess Eleven other children required trephination and recovered

TREATMENT – DIPHTHERIA CARRIERS

Medwick and Hallberg[11] believe that the finding of a fetid, irritating, unilateral or bilateral nasal discharge causing excoriation and swelling of the alae nasi and the upper

These findings suggest that it is possible for the otolaryngologist to do more to prevent recurring virus infections and their complications than either the pediatrician or the internist whose therapy is limited to vitamins, nasal drops and antibacterial drugs These measures usually lead to the recovery of the acute condition, but in no way protect against a recurrence of a virus infection The only known way to lessen the frequency of colds and to prevent recurrence of pyogenic complications is to remove or change the contour of hyperplastic or chronically infected nodules of lymphoid tissue in the nasopharynx with surgical operation, irradiation or both

This paper also describes their method of dealing with acute frontal sinusitis

Conservative treatment was effective in 16 out of 101 patients In the remaining 88, immediate external drainage was performed with excellent results, therefore, in addition to the administration of antibiotics, in selected cases, to relieve pain, lessen the danger of osteomyelitis and other complications they advocate external incision through the unshaven eyebrow and drainage The chief advantage of external drainage is that it makes unnecessary intranasal instrumentation, which not only is very painful but damages the acutely infected edematous mucous membrane of the nasofrontal duct The less the infected mucosa in this area is handled, the more likely it is to return to normal when the acute process subsides Nothing should be done, while trying to tide the patient over the acute period, that will traumatize the infected, edematous mucous membrane of the nasofrontal duct, since this may lead to the formation of granulations and scar tissue that permanently impair drainage, and to the development of a chronic sinusitis It is far easier to prevent a chronic sinus infection than it is to cure it

Smith and Spencer[9] review a group of cases illustrating infections, mucoceles, epidermoid cysts and osteomas of the nasal sinuses responsible for complications of the orbit There are no children among the 12 cases, but the grouping, description and illustrations are so good that the article should be

Hochfilzer[21] conducted differential blood examinations in children who showed clinical evidence of hyperplasia of Waldeyer's ring but gave no history of any serious infections of those structures The purpose was to find out whether the number of lymphocytes circulating in the blood is influenced by such hyperplasia It was clearly demonstrated that even very marked, long standing hyperplasia does not alter the absolute or relative number of lymphocytes This again brings out the fact that lymphoid tissue in the digestive tract embedded in the mucous membrane is functionally different from the lymphoid tissue in the lymph nodes Most of the lymphocytes produced in this structure find their way through the epithelium into the digestive tract Most authors feel the barrier theory is untenable but believe further investigation of the microchemical process of the lymph cells might bring light as to the function of the lymphoid tissue of Waldeyer's ring

Dalton[22] states that the relationship of hypothyroidism to the lymphoid hyperplasia and infection is never more marked than in hyperactivity of the thyroid gland He, therefore, believes it necessary to diagnose and correct thyroid dysfunction and suppurative sinusitis before removing hyperplastic lymphoid tissue by physical means In the majority of cases the more radical means will be unnecessary

Theobald[23] believes that more attention should be directed to routine examination of the nasopharynx He reviews 150 cases of epipharyngeal pathological conditions in the order of frequency of associated symptoms In 40 cases the most prominent symptom was postnasal discharge Next in order of frequency was recurrent sore throat which occurred in 35 cases The other conditions presented in order of frequency were cough, earache, recurrent colds, hoarseness and bronchitis, epipharyngitis, fever, bleeding, crusting, and one case each in occipital headache, asthma and tuberculosis

PHARMACOLOGY

House and Carey[24] call attention to some side effects of nasal vasoconstrictors that are apparently much more com-percentage of patients suffering with nasal symptoms are allergic and that failure to recognize early and treat properly the allergic state in these patients accounts for many therapeutic failures On the other hand, many patients suffering with allergic rhinitis will fare better if given the benefit of rhinologic attention

Calder[19] reports experiments in treatment with Anthisan of six cases of hay fever and 38 cases of vasomotor rhinitis Anthisan was effective in all six cases of hay fever and in 29 of the 38 cases of vasomotor rhinitis Side reactions developed in four of the 44 cases, but they were never severe

The dosage needed to keep the patient in comfort was, as a rule, 0 6 gr a day The treatment was tolerated well by children with 0 3 gr a day In 10 stabilized cases an attempt was made to reduce the dosage gradually but failed A constant dosage seems to be required, which cannot be reduced without return of part of the symptoms The dosage of 0 6 gr a day was preferred in three doses rather than divided into six doses

With two exceptions in the present series, the improvement in symptoms was accompanied by a corresponding improvement in the state of the nasal mucosa The pale, boggy turbinates shrunk and became pink, while the amount of secretion in the nose returned to normal Administration of Anthisan for weeks or months apparently did not damage the nasal mucosa

IRRADIATION

Gill[20] reports his observations on the clinical effectiveness of radium therapy in the pharynx from a series of 50 cases, about half of them children In a group of 14 patients with conduction deafness, normal hearing was recovered in seven Six adults were treated for aerotitis Of 15 children, 12 years of age or under, with allergic rhinitis and bronchial asthma, eight showed marked improvement after the second treatment, manifested by improvement in cough and decrease in nasal blockage and discharge Fifteen cases with perception deafness showed no improvement

Hochfilzer[21] conducted differential blood examinations in children who showed clinical evidence of hyperplasia of Waldeyer's ring but gave no history of any serious infections of those structures The purpose was to find out whether the number of lymphocytes circulating in the blood is influenced by such hyperplasia It was clearly demonstrated that even very marked, long standing hyperplasia does not alter the absolute or relative number of lymphocytes This again brings out the fact that lymphoid tissue in the digestive tract embedded in the mucous membrane is functionally different from the lymphoid tissue in the lymph nodes Most of the lymphocytes produced in this structure find their way through the epithelium into the digestive tract Most authors feel the barrier theory is untenable but believe further investigation of the microchemical process of the lymph cells might bring light as to the function of the lymphoid tissue of Waldeyer's ring

Dalton[22] states that the relationship of hypothyroidism to the lymphoid hyperplasia and infection is never more marked than in hyperactivity of the thyroid gland He, therefore, believes it necessary to diagnose and correct thyroid dysfunction and suppurative sinusitis before removing hyperplastic lymphoid tissue by physical means In the majority of cases the more radical means will be unnecessary

Theobald[23] believes that more attention should be directed to routine examination of the nasopharynx He reviews 150 cases of epipharyngeal pathological conditions in the order of frequency of associated symptoms In 40 cases the most prominent symptom was postnasal discharge Next in order of frequency was recurrent sore throat which occurred in 35 cases The other conditions presented in order of frequency were cough, earache, recurrent colds, hoarseness and bronchitis, epipharyngitis, fever, bleeding, crusting, and one case each in occipital headache, asthma and tuberculosis

PHARMACOLOGY

House and Carey[24] call attention to some side effects of nasal vasoconstrictors that are apparently much more common than the literature would indicate They present one case and review four others with the following conclusions as to the systemic effects that may follow the administration of Privine to children

1 Prolonged hypertension with peripheral vasoconstriction

2 Mild cortical stimulation, followed by depression

3 Depression of basal centers — bradypnea, low temperature, tachycardia followed by bradycardia

4 Resembles and potentiates the action of the barbitals in depression of respiration

PHYSIOLOGY

Proetz,[25] in an address at the Royal Society of Medicine, epitomized those individual observations in nasal physiology during the last 10 years which are apt to have an influence on our clinical management of nasal disease

His remarks should be read in the original Only a few observations can be given here

Today the teaching is to conserve tissues and functions wherever possible It is very desirable to maintain the continuity of streaming of mucus from sinus to sinus, to meatus, to nasopharynx Apparently a small amount of injury of the nasal mucosa did not appear to make much difference Numbers of people had considerable areas in the nose which were devoid of cilia altogether, and they got along just as well as other people If the mucosa was anything like normal, the cilia around the edge of an inactive area could pull the stream along for quite a distance, so that the inactive area did not really signify There were no cilia in the preturbinate area, and yet the cilia at the margin were strong enough to carry the whole mucus right across the surface If, therefore, the ciliated area were destroyed here and there, it did not seem to make much difference, though if the destruction was at an important spot, of course, there was trouble

It has been shown clinically that deficiency of the thyroid hormone may result in changes in the nasal mucosa which can be recognized These changes may be either exfoliative in nature or resemble the pale, boggy manifestations of allergy Patients deficient in the thyroid membrane commonly have an increased tendency to nasal infection which can be corrected by the administration of thyroid extract alone Similarly, allergic individuals are less apt to exhibit nasal symptoms under an adequate thyroid supply

Yoffey[26] states that the nose in mammals possesses a rich submucous lymphatic plexus, which drains finally into the deep cervical duct or jugular lymph trunk The deep cervical duct descends alongside the internal jugular vein to enter the thoracic duct on the left side and the right lymph duct on the right The deep cervical duct in man passes through several small lymph nodes strung along the course of the duct

This deep cervical pathway can be clearly demonstrated as a functioning unit by the nasal instillation of a vital dye The dye passes through the intact mucous membrane, enters the submucous lymphatics, and passes through the lymph nodes and the cervical duct to reach the blood Not only dyes but also proteins of low molecular weight, such as egg albumin with a weight of about 34,000, can readily pass through the living and intact nasal mucosa and be identified in the lymph of the cervical pathway

Particulate matter such as India ink does not traverse the mucous membrane after nasal instillation, nor do viruses, in a susceptible animal pass through the nasal mucosa immediately, however, after a period in which they proliferate locally and become established in the mucous membrane, they then enter the cervical pathway and reach the blood in a steady and continuous stream They are not prevented from reaching the blood stream by the filtering action of the cervical lymph node

The lymph in the cervical pathway in part arises from the capillary filtrate of the submucous blood vessels, but it also seems certain that some of the cervical lymph is derived from the cerebrospinal fluid, leaving the skull through the cribriform plate in association with the emerging bundles of the olfactory nerve

If bacteria and viruses behaved as inert ink particles, no infection of the nose would be likely to reach the brain, against the current of the cerebrospinal fluid On the other hand, bacteria or viruses which obtained access to the cerebrospinal fluid — *e g*, in meningitis — would certainly reach the nasal mucous membrane and the cervical pathway, and while viruses would find no difficulty in traversing this pathway, for the reasons already stated, bacteria would be held up in the uppermost node or two of the chain

Fabricant and Perlstein[27] state that the pH of nasal secretions *in situ* in clinically normal nasal passages of a group of 44 infants and children was found to range from 5 to 6 7 In a group of 17 infants and children with abnormal nasal findings, nasal pH ranged from 7 to 8 in acute rhinitis, from 6 7 to 7 2 in subacute and subsidiary rhinitis, and from 7 2 to 7 3 in active allergic rhinitis

The pH of nasal secretion *in situ* in the clinically normal nasal passages of infants and children has been found to range within levels (5 0 to 6 7) indicating a slightly acid state of the secretion Fabricant and Perlstein[5] studied the effect of hyperventilation and crying on the pH of nasal secretion *in situ* in a group of 39 infants and children, 13 children engaged in experimental hyperventilation, while 26 infants and children had their nasal pH recorded while they were crying Of the 13 children instructed to hyperventilate, six were found to show a measurable trend toward nasal alkalosis, and seven showed no appreciable variation in nasal state as indicated in pH In 23 of 26 infants and young children engaged in crying, the dominant finding was the establishment of an alkaline nasal state

HEMORRHAGE – NASAL

Dickie[29] remarks that epistaxis is, as a rule, a trivial condition and merits very little attention, as will be seen by the scanty references to it in rhinologic articles and textbooks It is evident on scanning most textbooks that the authors generally have had very little personal experience with severe nasal hemorrhage, judging by the treatment they recommend, however, at times it can be a dangerous condition He writes a long record of the various means he has employed The majority of the methods are applicable to children as well as adults The reader is recommended to the original

TONSILS AND ADENOIDS

In an editorial on the removal of children's tonsils,[20] the *British Medical Journal* states that an intelligent layman might well be surprised that doctors had not reached definite conclusions about the value of an operation which has been performed upon more than 1,500,000 children attending public elementary schools in England and Wales during the past 20 years, and he might argue that there should be a closed season for tonsils until more is known of their functions Though there is little precise knowledge on this point, few will deny that the location and cellular structure of the tonsils suggest that they contribute to the individual's defense against bacterial attack They may be compared to filters, with the cervical lymphatic glands as a second line of defense If it were possible to say from the patient's history and from direct observation that tonsils are diseased beyond natural repair, there would be a good case for their removal and, if it were surgically possible, their replacement by healthy tonsillar tissue The chief difficulty confronting the clinician is one of diagnosis Simple hypertrophy — probably a beneficial reaction — should no longer be regarded as an indication for operation, and the history of frequent recurrences of tonsillitis is now thought to be a more valuable guide than clinical examination of the tonsils Statistical evidence, though difficult to assess, would appear to favor a conservative attitude towards operation

There are, however, certain aspects of tonsillectomy which justify definite statements It is a major operation, never urgent, and it should be preceded by a period of observation of six months after the completion of any necessary treatment of teeth and sinuses, it should not be performed in Winter or early Spring, nor when infectious diseases are prevalent, and it seldom improves the condition of patients with established systemic diseases such as nephritis or rheumatism

Glover[31] believes that pediatricians should approach the problem of tonsillectomy with caution The incidence of tonsillectomy remains excessive, particularly in children between five and seven years of age This age distribution suggests that many tonsillectomies are performed because of enlargements which are either physiologic, associated with the great changes in development during this critical period, or immunologic responses to the unaccustomed infections met with on entrance to school or to the sepsis resulting from the decay of the primary teeth Tonsils cannot be determined as "diseased" or "infected" by clinical examination As their function includes the arrest of pathogenic organisms, the fact that these can be found in them is no justification for operation Tonsillectomy should command the respect due to a major operation In some cases it is followed by unpleasant sequelae It has a mortality which, though small, is larger than is generally appreciated Tonsillar remains may be more harmful than the original tonsils The most reliable indication is the occurrence of frequently repeated attacks of acute tonsillitis which cannot be explained by extraneous infection Indications such as frequent colds, chronic nasal catarrh and otitis media are misleading To remove the tonsils to cure sinusitis is to put the cart before the horse Certain other conditions, including bronchitis, asthma and nephritis, are definite contraindications The value of the operation in benefiting acute rheumatism is doubtful The incidence of otitis and mastoid disease is the same or perhaps slightly increased in the tonsillectomized, while their liability to bronchitis and pneumonia is increased

Penrose[32] writes that the whole question of the success or otherwise for the removal of tonsils and adenoids depends upon a proper selection of cases After a large number of years as a general practitioner and assistant medical officer of schools, he came to the following conclusions

1 It is one of the most successful operations when performed in suitable cases

2 It is often performed in unsuitable cases

3 The habit of bracketing tonsils and adenoids together is a mistake. Enlarged adenoids are infinitely more often the cause of trouble than enlarged tonsils, because they quickly obstruct nasal breathing and give rise to mouth breathing Enlarged tonsils alone very seldom do this

4 Tonsils should not be removed just because they are enlarged or because purulent-looking material can be expressed from them Tonsillectomy should be performed only when there is a history of recurrent attacks of tonsillitis with persistent enlargement of the tonsillar glands of the neck

5 Adenoids, however, should be removed if causing slight nasal obstruction, deafness or earache, and should always be followed by deep breathing exercises through the nose to re-establish nasal breathing If nasal breathing is not re-established the condition will recur

He believes that in children the tonsils are part of the mechanism of the manufacture of the antibodies of various infections, particularly streptococcal ones, and should be preserved if carrying out those functions properly Persistent enlargement of the tonsillar glands is evidence that they have failed and have become a permanent source of infection and should, therefore, be removed

Boies[33] states that although tonsillectomy should be a worn-out subject, he disagrees emphatically with the contention that the tonsil and its surgical treatment need be a problem When a tonsil operation is performed by one adequately trained and with good technique it is a highly satisfactory procedure in terms of the end-results He has not found it a simple minor surgical procedure, it is not followed by any serious morbidity and should never result in a mortality of six months after the completion of any necessary treatment of teeth and sinuses, it should not be performed in Winter or early Spring, nor when infectious diseases are prevalent, and it seldom improves the condition of patients with established systemic diseases such as nephritis or rheumatism

Glover[31] believes that pediatricians should approach the problem of tonsillectomy with caution The incidence of tonsillectomy remains excessive, particularly in children between five and seven years of age This age distribution suggests that many tonsillectomies are performed because of enlargements which are either physiologic, associated with the great changes in development during this critical period, or immunologic responses to the unaccustomed infections met with on entrance to school or to the sepsis resulting from the decay of the primary teeth Tonsils cannot be determined as "diseased" or "infected" by clinical examination As their function includes the arrest of pathogenic organisms, the fact that these can be found in them is no justification for operation Tonsillectomy should command the respect due to a major operation In some cases it is followed by unpleasant sequelae It has a mortality which, though small, is larger than is generally appreciated Tonsillar remains may be more harmful than the original tonsils The most reliable indication is the occurrence of frequently repeated attacks of acute tonsillitis which cannot be explained by extraneous infection Indications such as frequent colds, chronic nasal catarrh and otitis media are misleading To remove the tonsils to cure sinusitis is to put the cart before the horse Certain other conditions, including bronchitis, asthma and nephritis, are definite contraindications The value of the operation in benefiting acute rheumatism is doubtful The incidence of otitis and mastoid disease is the same or perhaps slightly increased in the tonsillectomized, while their liability to bronchitis and pneumonia is increased

Penrose[32] writes that the whole question of the success or otherwise for the removal of tonsils and adenoids depends upon a proper selection of cases After a large number of years as a general practitioner and assistant medical officer of schools, he came to the following conclusions

1 It is one of the most successful operations when performed in suitable cases

2 It is often performed in unsuitable cases

3 The habit of bracketing tonsils and adenoids together is a mistake Enlarged adenoids are infinitely more often the cause of trouble than enlarged tonsils, because they quickly obstruct nasal breathing and give rise to mouth breathing Enlarged tonsils alone very seldom do this

4 Tonsils should not be removed just because they are enlarged or because purulent-looking material can be expressed from them Tonsillectomy should be performed only when there is a history of recurrent attacks of tonsillitis with persistent enlargement of the tonsillar glands of the neck

5 Adenoids, however, should be removed if causing slight nasal obstruction, deafness or earache, and should always be followed by deep breathing exercises through the nose to re-establish nasal breathing If nasal breathing is not re-established the condition will recur

He believes that in children the tonsils are part of the mechanism of the manufacture of the antibodies of various infections, particularly streptococcal ones, and should be preserved if carrying out those functions properly Persistent enlargement of the tonsillar glands is evidence that they have failed and have become a permanent source of infection and should, therefore, be removed

Boies[33] states that although tonsillectomy should be a worn-out subject, he disagrees emphatically with the contention that the tonsil and its surgical treatment need be a problem When a tonsil operation is performed by one adequately trained and with good technique it is a highly satisfactory procedure in terms of the end-results He has not found it a simple minor surgical procedure, it is not followed by any serious morbidity and should never result in a mortality

In the minds of the laity — and for some of the medical profession — tonsil surgery is a cause for concern on three counts the indications, the probable inadequacy of the operation and the associated morbidity and even mortality In the hands of the trained laryngologist, none of these three aspects of the tonsil operation need be a cause for concern

The faucial tonsil which is cleanly enucleated with complete removal of the plicae does not grow back Lymphoid ingrowths from the lining of the fossa are common These are often erroneously called tonsil remnants Ordinarily these lymphoid ingrowths are not a source of any significant pathologic condition

The article is clear and concise and furnished with unusually appropriate illustrations

Gooch and Lillie[34] state that from the study of tonsil tags at the Mayo Clinic and of the literature on this subject, it is clear that the physiology of the tonsil is poorly understood Their study also indicates that the presence of tonsil tags is difficult to demonstrate in many instances and reliance should be placed on qualified otolaryngologists for this examination Tonsil tags were found to be more dangerous from a standpoint of infection than are whole tonsils

Myerson[35] presents a plea for greater attention to the adenoid operation He uses a modification of the Goodwillie palate retractor to afford visualization of the nasopharynx This retractor is in position at all times while the adenoid removal is in progress The instruments he uses are modifications of the Ruault instrument and of these he employs three sizes

Gray and Garson[36] state that adenitis of the tonsillar lymphatic gland is usually due to an infection of the throat that is clinically evident They report that from May to November, 1946, the outpatient department of the Belgrave Hospital for Children saw a minor epidemic of massive adenitis of the tonsillar lymphatic glands with minimal or no sign of tonsillar infection A series of 21 cases is described and there is a photograph of a typical patient There was no evidence of infectious mononucleosis, but eight children had a true lymphocytosis, and it seems possible that the condition was a variant of infectious lymphocytosis

Commenting on the preceding article, Miller and Court[37] state that in Newcastle-Upon-Tyne a team of visitors and doctors studying all the infectious illnesses of 1,100 infants have been watching for four months the development of an epidemic in that city which has been generally regarded as mumps The striking prominence in some cases of undoubted tonsillar lymphadenitis made them initially skeptical of that diagnosis, yet the speed of onset, the absence of pharyngitis, the minimal disturbance of general health, the incubation period of from 14 to 19 days, and the massive character of the swellings and their disappearance within a matter of days, suggested that this was an unusual type of lymphadenitis It was not until the disease affected one of their own families that a possible explanation was found, and they have no reason to doubt the diagnosis of mumps in these cases

From their observations they believe that mumps may cause a striking cervical lymphadenitis and wonder whether some of the cases reported by Gray and Garson could not be explained in this way

Livingston and Neary[38] studied tonsillectomized children less than 13 years of age to determine whether the routine post-tonsillectomy use of a chewing gum containing acetylsalicylic acid induces prothrombinopenia and, if so, whether secondary postoperative hemorrhage is etiologically related to the lowered blood prothrombin

A group of 29 such patients received chewing gum tablets containing approximately 0 23 gm (3 5 gr) of acetylsalicylic acid in a dosage of five to six tablets daily from the first to the seventh postoperative day A control group of the patients received, in the same dosage, chewing gum tablets containing a similar amount of acetylsalicylic acid and, in addition, 0 5 mg of menadione

No specific variation of prothrombin time, which normally appears to vary widely, could be ascribed to either acetylsalicylic acid or to the acetylsalicylic acid and menadione administered in chewing gum

Fox and West[30] point out that in several articles they have reported a study of 687 cases of tonsillectomy and adenoidectomy Group I included 216 patients who used aspirin chewing gum as desired through the postoperative period, of this number, 9 7 per cent reported late (secondary) bleeding In Group II, 128 patients took 10 mg of synthetic vitamin K twice daily for seven days postoperatively along with aspirin chewing gum as desired, in this group there was a 10 1 per cent incidence of secondary bleeding Group III consisted of 343 patients who were not permitted to use aspirin chewing gum at all, no synthetic vitamin K was taken by them, the incidence of late bleding in this group was 0 58 per cent

They concede that the simultaneous administration of vitamin K with salicylate will protect a normal individual against a salicylate-induced hypoprothrombinemia but hypoprothrombinemia is not considered the usual cause of late tonsillar bleeding They still consider that the high incidence of late tonsillar hemorrhage in patients using aspirin chewing gum is due to some local effect on the wound

They conclude that aspirin chewing gum, or similar locally-acting drugs, must be avoided entirely during the postoperative period

POLIOMYELITIS AND TONSILLECTOMY

The Lancet[10] is of the opinion that on present evidence it seems that the pharynx should continue to receive at least as much attention as the bowel when attempts are being made to trace the source from which the virus of poliomyelitis has spread The argument is as follows

The isolation of virus from the secretions and excretions of poliomyelitis patients and their contacts continues to occupy the attention of many investigators in the United States In

Chicago, during the Summers of 1945 and 1946, daily swabbings were made from the throats of children who were under observation as contacts Gordon and his associates subsequently tested pools of material from five of them, selected because they eventually developed poliomyelitis, and in three showed that virus was present in the pharyngeal secretions at varying periods up to six days before the clinical onset of the disease Virus has been isolated from the stools as early as 19 days before the onset of illness and as long as two months or more after recovery From the pharynx it has not been obtained after the first week of illness Studies such as those of Aycock and Kessel have shown that the infectivity of clinical cases is limited to a period extending from about four days before to about five days after the onset of illness This is almost precisely the time during which virus can be demonstrated in the pharynx and the correlation is sufficiently striking to suggest that case-to-case spread is more often due to the transmission of pharyngeal virus than of bowel virus

Unrecognized infectious and healthy carriers are the probable cause of poliomyelitis which cannot be ascribed to contact with a previous case — usually a proportion of at least 20 to 30 per cent in epidemics Melnick and others have found virus in the nasopharynx after illnesses regarded on circumstantial rather than on clinical grounds as poliomyelitis, and intestinal carriers of virus have often been found in contacts who were free of symptoms Search for healthy pharyngeal carriers has not yet been made on any large scale but Howe and Bodian recently demonstrated virus in the pharyngeal secretions of two out of 28 healthy children sharing a playground with the brothers and sisters of a clinical case, and Kessel and Moore, using material obtained during tonsillectomy, showed that virus was occasionally present in the nasopharynx of healthy children at times when there were no overt cases of poliomyelitis

Hilding[41] states that there is still a great deal of doubt as to the causative relationship between tonsillectomy and bulbar poliomyelitis He describes the unusual occurrence of polio-

No specific variation of prothrombin time, which normally appears to vary widely, could be ascribed to either acetylsalicylic acid or to the acetylsalicylic acid and menadione administered in chewing gum

Fox and West[30] point out that in several articles they have reported a study of 687 cases of tonsillectomy and adenoidectomy Group I included 216 patients who used aspirin chewing gum as desired through the postoperative period, of this number, 9 7 per cent reported late (secondary) bleeding In Group II, 128 patients took 10 mg of synthetic vitamin K twice daily for seven days postoperatively along with aspirin chewing gum as desired, in this group there was a 10 1 per cent incidence of secondary bleeding Group III consisted of 343 patients who were not permitted to use aspirin chewing gum at all, no synthetic vitamin K was taken by them, the incidence of late bleding in this group was 0 58 per cent

They concede that the simultaneous administration of vitamin K with salicylate will protect a normal individual against a salicylate-induced hypoprothrombinemia but hypoprothrombinemia is not considered the usual cause of late tonsillar bleeding They still consider that the high incidence of late tonsillar hemorrhage in patients using aspirin chewing gum is due to some local effect on the wound

They conclude that aspirin chewing gum, or similar locally acting drugs, must be avoided entirely during the postoperative period

POLIOMYELITIS AND TONSILLECTOMY

The Lancet[10] is of the opinion that on present evidence it seems that the pharynx should continue to receive at least as much attention as the bowel when attempts are being made to trace the source from which the virus of poliomyelitis has spread The argument is as follows

The isolation of virus from the secretions and excretions of poliomyelitis patients and their contacts continues to occupy the attention of many investigators in the United States In

Chicago, during the Summers of 1945 and 1946, daily swabbings were made from the throats of children who were under observation as contacts Gordon and his associates subsequently tested pools of material from five of them, selected because they eventually developed poliomyelitis, and in three showed that virus was present in the pharyngeal secretions at varying periods up to six days before the clinical onset of the disease Virus has been isolated from the stools as early as 19 days before the onset of illness and as long as two months or more after recovery From the pharynx it has not been obtained after the first week of illness Studies such as those of Aycock and Kessel have shown that the infectivity of clinical cases is limited to a period extending from about four days before to about five days after the onset of illness This is almost precisely the time during which virus can be demonstrated in the pharynx and the correlation is sufficiently striking to suggest that case-to-case spread is more often due to the transmission of pharyngeal virus than of bowel virus

Unrecognized infectious and healthy carriers are the probable cause of poliomyelitis which cannot be ascribed to contact with a previous case — usually a proportion of at least 20 to 30 per cent in epidemics Melnick and others have found virus in the nasopharynx after illnesses regarded on circumstantial rather than on clinical grounds as poliomyelitis, and intestinal carriers of virus have often been found in contacts who were free of symptoms Search for healthy pharyngeal carriers has not yet been made on any large scale but Howe and Bodian recently demonstrated virus in the pharyngeal secretions of two out of 28 healthy children sharing a playground with the brothers and sisters of a clinical case, and Kessel and Moore, using material obtained during tonsillectomy, showed that virus was occasionally present in the nasopharynx of healthy children at times when there were no overt cases of poliomyelitis

Hilding[41] states that there is still a great deal of doubt as to the causative relationship between tonsillectomy and bulbar poliomyelitis He describes the unusual occurrence of poliomyelitis in four brothers, two of whom had had tonsillectomies two weeks previously Three of the four developed bulbar symptoms, and only one of these had undergone tonsillectomy The one who had undergone tonsillectomy, however, was very much more ill than the other two, and eventually died, however, the second one who had undergone tonsillectomy was the only one of the four who showed no degree of bulbar palsy

Cunning[42] reports the survey of the United States reports made on the incidence of poliomyelitis in tonsillectomized patients for 1947 Although several hundred questionnaires had to be discarded for the lack of sufficient information, he has been able to tabulate in various ways the information from 25 states as compared with 13 states in 1946, and has traced *43 per cent* of the poliomyelitis cases reported throughout the country in 1947, as compared with 23 per cent for 1946 The disease was rather mild in 1947

After several years' work on this poliomyelitis-tonsillectomy survey, and watching the analysis and classification of thousands of cases in bulbar, spinal and mild into the different age groups, the number of poliomyelitis cases following tonsillectomies and those following other operations and injuries, from all sections of the country in mild years and severe ones, he is more convinced than ever that there is no causal relationship between the two and that when a bulbar poliomyelitis follows a tonsillectomy it is a coincidence

He does not advocate the indiscriminate removal of tonsils during any severe epidemic and has no desire to place his patients' lives in jeopardy through *injudicious* surgery, but he certainly does not think that this operation should be postponed indefinitely because the summer months are the months in which poliomyelitis is prevalent

He advocates that this survey be carried on from year to year, for he feels certain that when accurate statistics are available on thousands and thousands of these cases, it will be difficult to convince anyone that tonsillectomy predisposes a patient to poliomyelitis

The Section of Otorhinolaryngology[13] of the British Medical Association devoted a session to discussion of poliomyelitis and tonsillectomy

Allan M McFarlan recounted the history of five children in one family who developed bulbar paralysis nine to 14 days after tonsillectomy, three of them died Many workers had noted a tendency for the bulbar type of paralysis to develop within 30 days of operation Absence of tonsils appeared to predispose towards the bulbar rather than the spinal type of paralysis He admitted the risk was very small, but it was, of course, greater during epidemics The only safeguard was to avoid operations on the tonsils during an epidemic

Geoffrey H Bateman said that clinicians had refrained from operation during epidemics mainly because of publicity, but the risk was extremely small, even at the height of the epidemic The effect of the four months' break in operating in 1947 had been to add enormously to the waiting list He thought parents were better judges than the physicians of the harm caused to their children by such postponements

In reply to the question as to why this operation was singled out, it was stated that operations other than tonsillectomy appeared to have no bearing on the paralysis

Layton[14] discusses an opinion expressed at the Preventive Medicine Session of the British Medical Association that the prohibition of tonsillectomy during epidemics of poliomyelitis is the only useful administrative measure of control against the disease The authority concerned, a leader in his branch of medicine, wants temporarily to stop all removal of tonsils during a time when some disease is prevalent that seems to him of greater importance

Let us see where such an order might lead us to Poliomyelitis is not the only disease to which it might be applied The post-tonsillectomy measles mastoid is so deadly that to take out tonsils during an epidemic of measles from a child who has not had the disease is as risky as to do so during an epidemic of poliomyelitis Then, were such an order made, myelitis in four brothers, two of whom had had tonsillectomies two weeks previously Three of the four developed bulbar symptoms, and only one of these had undergone tonsillectomy The one who had undergone tonsillectomy, however, was very much more ill than the other two, and eventually died, however, the second one who had undergone tonsillectomy was the only one of the four who showed no degree of bulbar palsy

Cunning[12] reports the survey of the United States reports made on the incidence of poliomyelitis in tonsillectomized patients for 1947 Although several hundred questionnaires had to be discarded for the lack of sufficient information, he has been able to tabulate in various ways the information from 25 states as compared with 13 states in 1946, and has traced *43 per cent* of the poliomyelitis cases reported throughout the country in 1947, as compared with 23 per cent for 1946 The disease was rather mild in 1947

After several years' work on this poliomyelitis-tonsillectomy survey, and watching the analysis and classification of thousands of cases in bulbar, spinal and mild into the different age groups, the number of poliomyelitis cases following tonsillectomies and those following other operations and injuries, from all sections of the country in mild years and severe ones, he is *more convinced than ever that there is no causal relationship between the two and that when a bulbar poliomyelitis follows a tonsillectomy it is a coincidence*

He does not advocate the indiscriminate removal of tonsils *during any severe epidemic and has no desire to place his patients' lives in jeopardy through injudicious surgery*, but he certainly does not think that this operation should be postponed indefinitely because the summer months are the months in which poliomyelitis is prevalent

He advocates that this survey be carried on *from year to year*, for he feels certain that when accurate statistics are available on thousands and thousands of these cases, it will be difficult to convince anyone that tonsillectomy predisposes *a patient to poliomyelitis*

The Section of Otorhinolaryngology[13] of the British Medical Association devoted a session to discussion of poliomyelitis and tonsillectomy

Allan M McFarlan recounted the history of five children in one family who developed bulbar paralysis nine to 14 days after tonsillectomy, three of them died Many workers had noted a tendency for the bulbar type of paralysis to develop within 30 days of operation Absence of tonsils appeared to predispose towards the bulbar rather than the spinal type of paralysis He admitted the risk was very small, but it was, of course, greater during epidemics The only safeguard was to avoid operations on the tonsils during an epidemic

Geoffrey H Bateman said that clinicians had refrained from operation during epidemics mainly because of publicity, but the risk was extremely small, even at the height of the epidemic The effect of the four months' break in operating in 1947 had been to add enormously to the waiting list He thought parents were better judges than the physicians of the harm caused to their children by such postponements

In reply to the question as to why this operation was singled out, it was stated that operations other than tonsillectomy appeared to have no bearing on the paralysis

Layton[14] discusses an opinion expressed at the Preventive Medicine Session of the British Medical Association that the prohibition of tonsillectomy during epidemics of poliomyelitis is the only useful administrative measure of control against the disease The authority concerned, a leader in his branch of medicine, wants temporarily to stop all removal of tonsils during a time when some disease is prevalent that seems to him of greater importance

Let us see where such an order might lead us to Poliomyelitis is not the only disease to which it might be applied The post-tonsillectomy measles mastoid is so deadly that to take out tonsils during an epidemic of measles from a child who has not had the disease is as risky as to do so during an epidemic of poliomyelitis Then, were such an order made, he would demand that it be extended to all such operations during the Winter months and should have behind him the support of many leading physicians He applied the principle of cessation of tonsil operations during Winter months and during measles epidemics for 20 years and had never seen any "trouble" arising from the delay, but if temporary cessations, seasonal and epidemiological, of tonsillectomy are much to be desired, why should not the administrative fiat be extended to the whole holocaust of tonsils that has been going on for a quarter of a century? It might be ordered that none should be removed under the age of nine, and then only for indications that could not be exceeded No! Salutary as such orders would be in many ways, we cannot conduct the art of medicine by administrative fiats, and this part of the art must be amended by two other methods

The first is that the profession as a whole should reconsider its approach to tonsillectomy Practically every experienced physician in the land deprecates its excessive frequency The Ministry of Education has, short of dictation, done all it can to limit the number arising from its school inspections Yet, still it goes on to such an extent that it can only be explained as being due to a disharmony of the human mind Future generations will, he believes, wonder, and some may laugh, at our propensity to it, just as we do at the bleeding and purging of the end of the eighteenth and beginning of the last century

The other is that parents should again assume the responsibility for decision that they have so long laid aside The doctor does not order, he advises If parents would say, "No, I will not have my child operated on until the epidemic is over (or until the Winter is past)," they would find that the child is none the worse for the delay, and often that it has entirely recovered from the symptoms for which the operation was originally advised The reassumption of their responsibility might thus lead inquiring minds to demand more from the doctors who advise this operation than they have in the past, and this in turn might ensure the profession as a whole making that reconsideration that seems so necessary

FRACTURE DISLOCATION OF THE NOSE

Becker[45] found fractures in 100 out of more than 135 cases of nasal injuries From his study of these, he formulates certain principles of management Approximately half the cases were children

This is a relatively long, illustrated article and only certain of his conclusions which apply definitely to children are here mentioned

Early reduction, within the first few hours, is the procedure of choice Epistaxis is often troublesome It and edema may cause the surgeon to delay It is better to wait until the edema has subsided sufficiently so that the true extent of the deformity can be studied In some cases the fracture was reduced early, only to have it found a week later, when the edema had subsided, that there was still deformity which required secondary manipulation

When the fracture was compounded externally and dirt had entered the wound, tetanus antitoxin and antibiotics or chemotherapy were administered

Fractures seen as late as two or three weeks after injury can be reduced

Fractures properly reduced are maintained in position by petrolatum gauze packing internally and dental moulding compound externally Once reduced, the fragments will not again become displaced The petrolatum packing was left in place from three to five days, the amount of time depending upon the severity of the fracture

SURGERY

Lefkon[46] believes that rhinoplastic procedures in children may be safely undertaken at an early age without in any way impairing the future development of the organ, and that in this way faulty facial development may be prevented, normal nasal function established and psychologic and physiologic disturbances *detrimental to the growing child avoided*

In support of his assertion, he makes short references to articles describing the successful correction of a number of abnormalities and describes fully a successful result of his own

This patient was a boy aged nine years and six months His general appearance was that of a child with adenoid The nasal bones were separated in the midline and the dorsum was flat The ridges of the ununited nasal bones could easily be felt The lower end of the nasal septum was S-shaped and projected into both nasal chambers These factors, operating during the developmental period, resulted in the formation of a high palatal arch and a narrow protruding upper jaw causing malocclusion and overriding of the teeth

Three operations were performed hypertrophied lymphoid tissue in the nasopharynx was removed, the dislocated nasal septum was repaired, seven months later the flattened nasal dorsum was corrected by the insertion of a graft of preserved cartilage

Many details are given which suggest that all the original defects, structural, physiological and psychological and dental, have been successfully overcome

NEW GROWTHS

Marks and Johnstone[12] discuss *nasal rhinosporidiosis* and report two cases, one of them in a girl, aged 11 Although rhinosporidiosis has a worldwide distribution, only 15 cases had previously been reported in the United States The condition should be suspected when a mass in the nose is polypoid or papillomatous, with a strawberry-like appearance varying from a pink to a deep red, which bleeds readily Using a proper light source, small white spots will be found distributed over the entire surface of the growth These are the sporangia The authors emphasize the necessity of preparing histologic sections of all nasal tumors so that the correct diagnosis may be reached

Cruthirds[4[illegible]] describes the course of illness of a boy of four years of age who developed a swelling in the nasopharynx which terminated fatally with metastases in the lungs

The boy was originally examined for a cold but three weeks later began to complain of difficulty in breathing, and four days later, quite blue and dyspneic, was found to have a swelling in the right side of the throat In the belief that it was a peritonsillar abscess, it was incised several times Some time later an otolaryngologist diagnosed the mass as a tumor and not an abscess Two weeks later a hard nodular mass was without difficulty removed from the right pharynx and eventually diagnosed as an angioendothelioma arising from the buccal mucosa of the soft palate Roentgenogram of the chest showed no metastases or bronchopneumonia He soon ate well, slept well, breathed comfortably and seemed normal in every way Five months later, however, routine chest radiography showed large areas of metastases which were growing rapidly and the patient soon died

From this case the author urges that the postnasal space in the child should undergo more thorough and frequent examination for early detection of tumors, as earlier treatment means better prognosis Although angioendotheliomas are rare and do not metastasize frequently, the majority become malignant and may metastasize Early treatment with X-ray and radium offers the patient his best chance

BIBLIOGRAPHY

1 Head Colds in a Child Any Questions? *Brit Med Jour* 668 Oct 1948

2 Oral Penicillin in Children Annotation *Brit Med Jour* 867 Nov 1948

3 Vitamin C in Acute Rhinitis Answer to Query *Jour A M A*., 466 Oct., 1948

4 Cowan D W and Diehl Cold Prevention Study Influenza Vaccine for Prevention of Common Cold. *Minn Med*., 504 May 1948 reviewed by *Jour A M A* 456 Oct. 1948

5 Dukes R. E. and Gillespie, J B Immunization of Children with Influenza Virus Vaccine Clinical Observations *Ill Med Jour*., 252 May 1948 reviewed by *Jour A. M A* 716 Oct. 1948

6 Brewster, J M Benadryl as Therapeutic Agent in Treatment of Common Cold Review *Jour A. M A*., 65 Jan 1948

7 Crowe, S J, and Lett James E The Etiology Treatment and Prevention of Chronic Sinus Infection *Ann Otol, Rhinol and Laryngol* 364 June, 1948

8 Smith Austin T, and Spencer, James T Orbital Complications Resulting from Lesions of the Sinuses *Ann Otol, Rhinol and Laryngol* 5, Mar, 1948

9 Glass, Gilroy Osteomyelitis of Frontal Bone Following Acute Frontal Sinusitis *Jour Laryngol and Otol*, 310 May, 1948

10 Johnson, Ernest D Acute Frontal Sinusitis *Arch Otolaryngol* 165, Feb, 1948

11 Medwick, Joseph X, and Hallberg, Olaf E Treatment of Chronic Nasal Diphtheria Carriers *Ann Otol, Rhinol and Laryngol*, 131, Mar 1948

12 Hansel, French K Black, W Byron, and Ashley Rea E Allergy in Otolaryngology The Laryngoscope, 652, July, 1948

13 The Mystery of the Eosinophile Editorial *Brit Med Jour* 958 May, 1948

14 Turner, H M Stanley The Mystery of the Eosinophile Correspondence *Brit Med Jour*, 1051, May, 1948

15 Baralian, L New Ideas on Skin Tests for Food Allergies. *Me Med Assn Jour*, 194, July, 1948, reviewed by *Jour A M A*, 996 Nov 1948

16 Allergy and the Eye Annotation *Brit Med Jour* 57, Jan 1948

17 Allergy to Vitamins Answer to Query *Jour A M A* 720 Oct 1948

18 Criep, L H Practical Aspects of Allergic Rhinitis *Jour A M A* 601, Feb, 1948

19 Calder, A G S Anthisan in the Treatment of Allergic Rhinitis. *The Lancet*, 863, June, 1948

20 Gill, E King Comments on the Results of Treatment with the Nasal Radium Applicator The Laryngoscope, 1103 Oct 1948

21 Hochfelzer, John J The Meaning of Lymphoid Tissue The Laryngoscope, 712, July, 1948

22 Dalton, S Eugene Lymphoid Hyperplasia of the Nasopharynx. *Arch Otolaryngol* 641 May 1948

23 Theobald, Walter H Associated Symptomatology of Diseases of the Epipharynx *Ann Otol, Rhinol and Laryngol* 677, Sept, 1948

24 House, Leland R and Carey Wells C Constitutional Effects from the Use of Sympathomimetic Drugs as Nasal Medication in Children, Report of Case of Privine Toxicity The Laryngoscope 1291 Dec 1948

25 Proetz, Arthur W Recent Progress in Nasal Physiology *Proc Roy Soc Med*, 793, Nov, 1948

26 Yoffey, J M The Nasal Mucous Membrane in Relation to the Lymph Stream and the Cerebrospinal Fluid *Proc Roy Soc Med* [illegible] Nov, 1948

27 Fabricant Noah D, and Perlstein M A Hydrogen Ion Concentration of Nasal Secretion in Situ in Infants and in Children *Arch Otolaryngol* 765 June, 1948

28 Fabricant Noah D and Perlstein, M A pH of Nasal Secretion in Situ in Infants and in Children *Arch Otolaryngol*, 67 July 1948

29 Dickie, J K. M Nasal Hemorrhage *Canad Med Assn Jour*, 121 Feb., 1948

30 Removal of Children s Tonsils Annotation. *Brit Med Jour* 564 Sept. 1948

31. Glover, J A. Pediatric Approach to Tonsillectomy *Arch Dis Children*, 1 Mar 1948 reviewed by *Jour A M A* 1631 Aug 1948

32 Penrose, N C Use and Abuse of Tonsillectomy Correspondence *Brit Med Jour*, 919 Nov 1948

33 Boies, Lawrence R. Tonsillectomy in the United States *Ann Otol., Rhinol and Laryngol*, 352 June 1948

34 Gooch, J Oliver and Lillie, Harold I A Clinical and Pathological Study of Tonsil Tags *Ann Otol*, *Rhinol and Laryngol.*, 957 Dec 1948

35 Myerson, M C Adenoids Their Visualization and Removal The Laryngoscope 542 June 1948

36 Gray, J D and Garson John Massive Tonsillar Lymphatic Adenitis. *The Lancet* 406 Mar 1948

37 Miller, F J W and Court S D Massive Tonsillar Lymphatic Adenitis Correspondence *The Lancet* 612 Apr 1948

38 Livingston George S and Neary, Edward R The Question of Thrombinopenic Hemorrhage from Post tonsillectomy Use of Chewing Gum Containing Acetylsalicylic Acid. *Arch Otolaryngol* 1 Jan 1948

39 Fox Samuel L and West, G Brooke Bleeding Following Tonsillectomy and Adenoidectomy *Ann Otol*, *Rhinol and Laryngol* 1032 Dec 1948

40 Poliomyelitis and the Nasopharynx. Annotation *The Lancet* 148 Jan. 1948

41 Hilding, A. C Simultaneous Poliomyelitis in Four Brothers Two of Whom Had Recently Had Tonsillectomies *Ann Otol Rhinol and Laryngol.*, 217 Mar 1948

42 Cunning Daniel S Tonsillectomy Poliomyelitis Survey 1947 The Laryngoscope, 503 June 1948

43 Poliomyelitis and Tonsillectomy Summary of Proceedings *Brit Med Jour* 151 July, 1948

44 Layton, T B Use and Abuse of Tonsillectomy Correspondence *Brit Med Jour* 310 Aug 1948

45 Becker, Oscar J Nasal Fractures — An Analysis of 100 Cases *Arch Otolaryngol.*, 344 Sept., 1948

46 Lefkon Irving M Rhinoplasty in Children *Arch Otolaryngol*, 73 July 1948

47 Marks R Foster, and Johnstone, Herbert G Nasal Rhinosporidiosis. The Laryngoscope. 1108 Oct. 1948

48 Cruthirds A. E Angioepithelioma of the Postnasal Space *Ann Otol.*, *Rhino and Laryngol* 230 Mar 1948

7 Crowe, S J, and Lett James E The Etiology Treatment and Prevention of Chronic Sinus Infection *Ann Otol, Rhinol and Laryngol* 364, June, 1948

8 Smith, Austin T, and Spencer, James T Orbital Complications Resulting from Lesions of the Sinuses *Ann Otol, Rhinol and Laryngol* 5, Mar, 1948

9 Glass, Gilroy Osteomyelitis of Frontal Bone Following Acute Frontal Sinusitis *Jour Laryngol and Otol*, 310, May, 1948

10 Johnson, Ernest D Acute Frontal Sinusitis *Arch Otolaryngol* 165, Feb, 1948

11 Medwick, Joseph X, and Hallberg, Olaf E Treatment of Chronic Nasal Diphtheria Carriers *Ann Otol, Rhinol and Laryngol* 134 Mar, 1948

12 Hansel, French K Black, W Byron, and Ashley Rea E Allergy in Otolaryngology The Laryngoscope, 652, July, 1948

13 The Mystery of the Eosinophile Editorial *Brit Med Jour* 93 May, 1948

14 Turner, H M Stanley The Mystery of the Eosinophile Correspondence *Brit Med Jour*, 1051, May, 1948

15 Barattian, L New Ideas on Skin Tests for Food Allergies *Mo Med Assn Jour*, 194, July, 1948, reviewed by *Jour A M A* 996, Nov 1948

16 Allergy and the Eye Annotation *Brit Med Jour* 57 Jan 1948

17 Allergy to Vitamins Answer to Query *Jour A M A* 720 Oct 1948

18 Criep, L H Practical Aspects of Allergic Rhinitis *Jour A M A* 601, Feb, 1948

19 Calder, A G S Anthisan in the Treatment of Allergic Rhinitis *The Lancet*, 863, June, 1948

20 Gill, E King Comments on the Results of Treatment with the Nasal Radium Applicator The Laryngoscope, 1103 Oct 1948

21 Hochfilzer, John J The Meaning of Lymphoid Tissue The Laryngoscope, 712, July, 1948

22 Dalton, S Eugene Lymphoid Hyperplasia of the Nasopharynx *Arch Otolaryngol*, 641, May, 1948

23 Theobald, Walter H Associated Symptomatology of Diseases of the Epipharynx *Ann Otol, Rhinol and Laryngol*, 677 Sept 1948

24 House, Leland R, and Carey Wells C Constitutional Effects from the Use of Sympathomimetic Drugs as Nasal Medication in Children, Report of Case of Privine Toxicity The Laryngoscope 1291 Dec 1948

25 Proetz, Arthur W Recent Progress in Nasal Physiology *Proc Roy Soc Med*, 793, Nov, 1948

26 Yoffey, J M The Nasal Mucous Membrane in Relation to the Lymph Stream and the Cerebrospinal Fluid *Proc Roy Soc Med* 7 Nov, 1948

27 Fabricant, Noah D, and Perlstein, M A Hydrogen Ion Concentration of Nasal Secretion in Situ in Infants and in Children *Arch Otolaryngol*, 765, June 1948

28 Fabricant, Noah D and Perlstein, M A pH of Nasal Secretion in Situ in Infants and in Children *Arch Otolaryngol* 67 July 1948

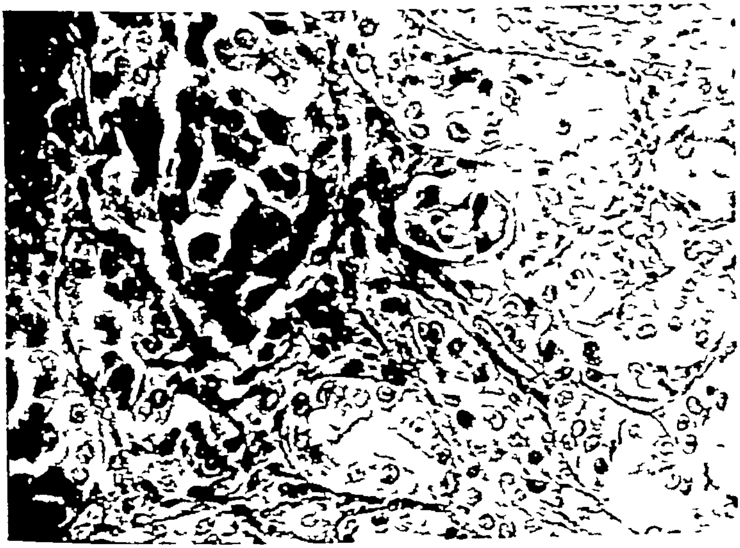


Fig. 1. Adenocystic adenocarcinoma of the tongue Histopathologic diagnosis of biopsy specimen mucoepidermoid tumor of salivary gland type Diagnosis at autopsy metastasis from hypernephroma of the right kidney (× 120)

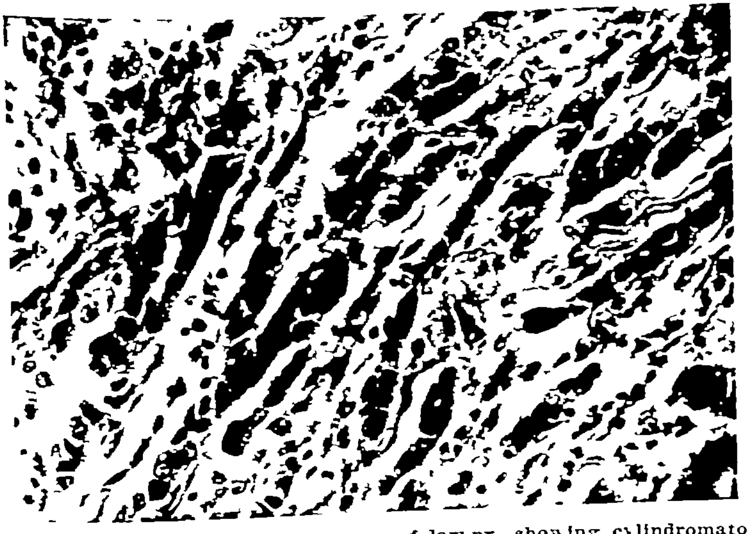


Fig 2. Adenocystic adenocarcinoma of larynx, showing cylindromatous pattern. Same patient as Fig 1. Histopathologic diagnosis of biopsy specimen mucoepidermoid tumor of salivary gland type Diagnosis at autopsy metastasis from hypernephroma of the right kidney (× 210)

MINOR SALIVARY GLAND TUMORS IN RESPIRATORY TRACT AND EAR *

Review of the Literature and Report of Two Cases

HAROLD OWENS, M D ,
Los Angeles, Calif

Some time ago the author discovered in a white male patient, 68 years of age, a small tumor in the anterior third of the left side of the dorsum of the tongue and also a much larger growth on the left true vocal cord and ventricle Microscopic examination of tissue specimens proved the two masses to be of identical arrangement, and a diagnosis of mucoepidermoid tumor, originating within the minor salivary glands, was made by the pathologist (see Figs 1 and 2) The patient died shortly after At time of autopsy, a large hypernephroma of identical structure to the oral lesions was found to have existed in the right kidney The growths of the tongue and vocal cord had consequently to be interpreted as metastatic growths of adenocystic adenomatous, and cylindromatous arrangement

Metastases of so-called "mixed tumors" of the kidney to the oral cavity, ear, larynx and thyroid have been variously reported [8-] Nevertheless, the case briefly described in the foregoing could not fail to direct attention towards the study of salivary gland tumors in the somewhat less usual locations outside of the major salivary glands It is perhaps noteworthy that within a relatively short time thereafter two instances of true mixed tumors of the minor salivary glands were encountered in private practice The author, furthermore,

---

*Presented as Candidate s Thesis to American Laryngological Rhinological and Otological Society Inc 1949

Editor s Note This ms received in Laryngoscope Office and accepted for publication May 2 1949

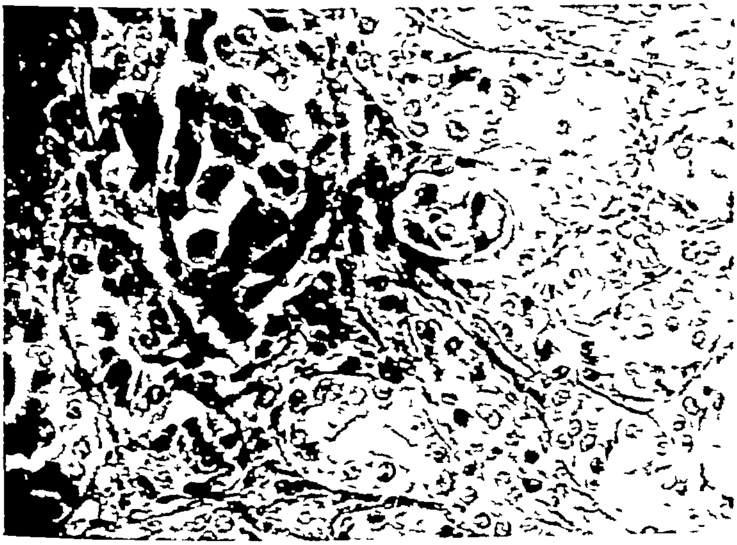


Fig. 1. Adenocystic adenocarcinoma of the tongue Histopathologic diagnosis of biopsy specimen mucoepidermoid tumor of salivary gland type Diagnosis at autopsy metastasis from hypernephroma of the right kidney (× 120)

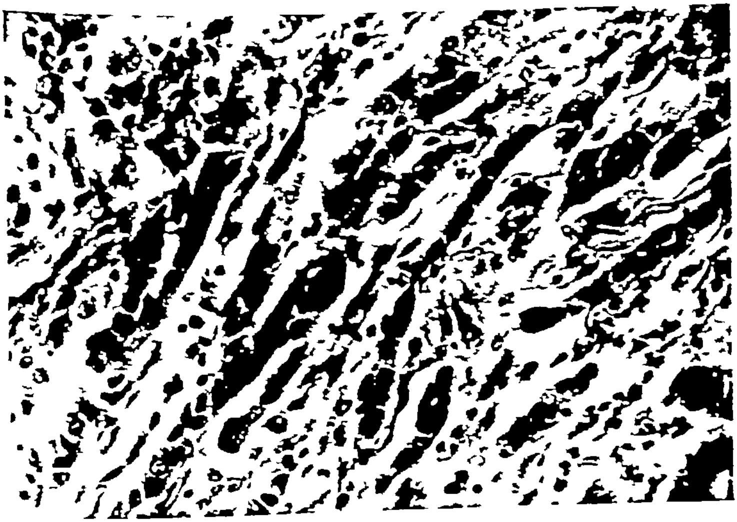


Fig 2. Adenocystic adenocarcinoma of larynx, showing cylindromatous pattern. Same patient as Fig 1. Histopathologic diagnosis of biopsy specimen mucoepidermoid tumor of salivary gland type. Diagnosis at autopsy metastasis from hypernephroma of the right kidney (× 210)

was able to obtain data on two additional cases of the same type, through the kindness of Dr J M Brown and Dr C E Futch, both of Los Angeles

While, of course, no conclusions can be drawn from such a small group of cases, the seemingly frequent occurrence of minor salivary gland tumors contrasts sharply with the prevailing opinion expressed, for instance, by McFarland,[6] that in most hospitals only a very few cases of this kind are seen each year In this connection it may be of interest that at Los Angeles County General Hospital, with 58,418 admissions dur 1947, not a single case of minor salivary gland tumor was reported by the department of surgical pathology This question of the incidence of minor salivary gland tumors cannot be conclusively decided on the basis of a tabulation of a great number of published cases, however, it would appear that neoplasms of this type, though undoubtedly far less frequent than tumors of the major salivary glands, are not so rare as had hitherto been assumed

Similar difficulties, as in the question of the incidence of minor salivary gland tumors, are encountered in various other respects Ahlbom[3] has made the pertinent observation that a conclusive understanding of these peculiar neoplasms requires a very large clinical and pathological tumor material While a review of the literature should by no means be regarded as a substitute for such far-reaching study, it may at least be able to convey a preliminary impression of some of the more significant aspects of this group of neoplasms Before reporting the results of this statistical and bibliographical research, a short review of the successive theories concerning minor salivary gland tumors and a brief description of their most characteristic histopathologic features will be attempted

HISTORY

According to Ahlbom,[3] Ch G and J B Siebold in 1793 and 1797, respectively, were the first authors to dedicate a separate monograph to the study of salivary gland tumors The term "mixed tumor" was introduced by Minssen, in 1871

Tumors outside of the major salivary glands received attention for the first time in 1851, when James Paget observed that mixed tumors of the lip have identical characteristics with mixed tumors of the parotid gland Stephen Paget (1886) developed the theory that these tumors of salivary type may originate from any one of the small glands in the oral mucosa, but the glandular genesis of the entire group of mixed salivary tumors was conclusively proved only by Berger, in 1922

The question as to the nature of the tissue within these glands, giving rise to mixed salivary tumors, has been variously answered at different times A theory of mesenchymal origin was proposed by Billroth (1859) and Virchow (1863) Cohnheim, in 1883, introduced the hypothesis of branchial genesis of these neoplasms, a view which was modified and extended by Gontier, in 1904 At the present time, the prevalent theory is that these tumors originate wholly or at least chiefly from epithelial tissue, an interpretation defended by Krompecher in a series of papers and conclusively established by Zymbal,[90] in 1933

HISTOLOGICAL CLASSIFICATION

Before it is possible to give a description of the pathologic characteristics of tumors of salivary gland structure, appearing within the minor glands of respiratory tract and ear, it is necessary to ascertain what we understand when speaking of "salivary gland structure" as a type of histologic arrangement This difficulty was solved by Ahlbom[3] in the following manner "We count as salivary tumors all those growths from the regions in question which used to be called adenoma, basalioma, mixed tumors (benign and malignant), cylindroma, endothelioma, papillary cystic salivary gland tumors, different types of carcinoma (epithelioma) and sarcoma" Long as this list may be, the group of typical mixed tumors is usually further subdivided into fibroepitheliomas, fibromyxomas, chondromas, etc[2]

It is understandable that attempts should have been made to simplify this extended list of morphological types of salivary gland neoplasms According to Ewing,[27] three groups

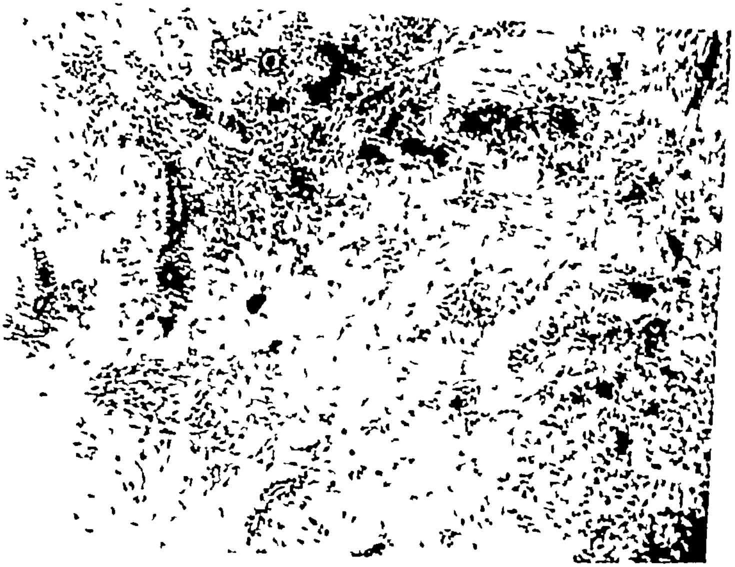


Fig 3 Mixed tumor of salivary gland type Epithelial cells in characteristic arrangement and mucinous ground substance (× 120)

In other instances, mixed salivary tumors can be described as basal-cell carcinomas with hyaline stroma Neoplasms of this type are composed of small, cuboid or spindle-shaped cells, with hyperchromatic nuclei, and arranged in cords or strands which fuse with the hyaline stroma

In a number of salivary gland tumors, the epithelial cells show *cylindromatous* arrangement (see Fig 4) The stroma of the tumor consists of coarse hyaline matter, arranged into more or less parallel bundles between which the cellular and glandular elements are compressed[5] The coarse trabeculae of connective tissue may undergo mucoid degeneration[7] The epithelial cells are small and dark staining, and are arranged in cylinders or plugs which honeycomb the stroma[1] The cellular arrangement resembles to a certain degree the adenocystic type of basal-cell carcinoma

A third group of neoplasms, appearing within the various salivary glands, has been described by Stewart, Foote and Becker[51] as *mucoepidermoid tumors* (see Fig 5) They are characterized by the presence of numerous mucous cells more

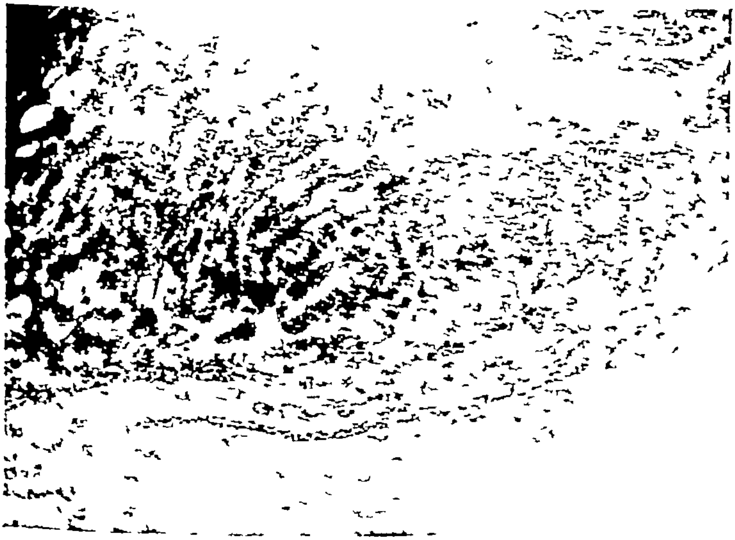


Fig. 4 Mixed tumor of salivary gland type Cylindromatous arrangement of epithelial cells (× 120)

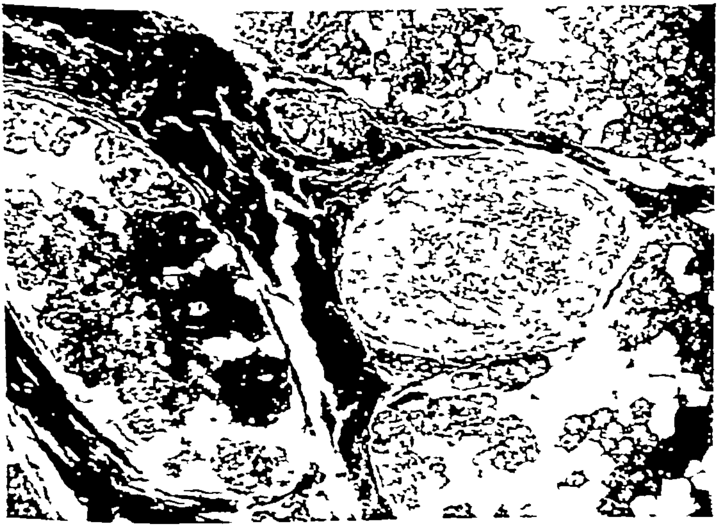


Fig 5 Mucoepidermoid tumor of salivary gland type There is involvement of ducts near the center surrounded by normal glandular tissue (× 120)

of epithelial tumors appear within the salivary glands benign adenoma, malignant adenocarcinoma or carcinoma, and autochthonous mixed tumors, the latter group composed of myxochondrocarcinoma, basal-cell carcinoma with hyaline stroma, and adenoid cystic epithelioma Stout[82] believes that in the main only three groups of tumors appear within the salivary glands of the upper alimentary and respiratory tracts adenoma (including cystoadenoma lymphomatosum), mixed tumors, and carcinoma Willis[87] concedes that many of the formerly used names were convenient for descriptive purposes but feels that on the basis of histogenesis only the following subgroups should be distinguished simple adenomas, pleomorphic adenomas and adenocarcinomas (so called "mixed" tumors), anaplastic carcinomas, adenolymphomas

Simultaneous with this tendency towards greater simplification of the histologic terms used in the description of salivary gland type tumors, there appeared a contrasting trend towards still greater differentiation Dockerty and Mayo,' for instance, distinguished four different types of histologic arrangement within that group of neoplasms hitherto labeled "mixed" tumors *1* adenocarcinoma of mixed tumor type, *2* adenocarcinoma of cylindromatous type, *3* adenocarcinoma of intermediate form, *4* miscellaneous, *i e*, tumors which were difficult to classify under the foregoing headings Stewart, Foote and Becker[81] were able to differentiate on the basis of specific pathologic characteristics a subgroup, amounting to a little more than 5 per cent of all major and minor salivary gland tumors combined, which they named mucoepidermoid tumor of the salivary glands

In this respect, a statistical evaluation of cases of tumors of salivary gland type within respiratory tract and ear— exclusive of the major salivary glands, and published during the past 20 years — may be of interest Completeness of this survey was not intended and in numerous instances it proved impossible to ascertain whether duplication had slipped in It is, however, hoped that the following statistical tabulation, incomplete as it may be, will provide an approximate idea of the prevailing opinions on the subject (see Table 1)

TABLE 1

Histologic Classification of Tumors of the Minor Salivary Glands Published During the Past 20 Years Four Additional Cases Two of Which Were the Author's Own the Others Obtained Through Personal Communications Have Been Added

Mixed tumors	244
Mixed tumors of parotid type	10
Cylindroma	118
Basalioma	4
Adenoma	2
Myeloma	2
Myoblastoma	5
Mucoepidermoid tumors	14
Endothelioma	12
Epithelioma	176
Carcinoma mostly basal cell carcinoma	32
Adenocarcinoma	228
Sarcoma	39
Not specified	252
Total number of cases	1 138

In a number of instances it proved necessary to simplify the published histologic diagnosis for the sake of statistical uniformity For instance, a case diagnosed as "epithelioma adenoides cysticum, or cylindroma — a variety of basal cell carcinoma"[24] has been classified under "epithelioma", similarly, a case described as "mixed tumor of salivary gland type, epithelioma adenoides cysticum"[16] has also been classed as "epithelioma", a tumor variously diagnosed as "myxochondroendothelioma, adenocarcinoma and cylindroma"[38] has been entered as "endothelioma" "Fibromyxoepithelial tumors," as they often occur in Ahlbom's[3] report, were counted as mixed tumors Quite generally, cases were classified according to their major characteristics while minor differentiations, as for instance, "encapsulated mucous and salivary gland tumor of the basalioma type with cylindromatous areas," could not be taken into consideration

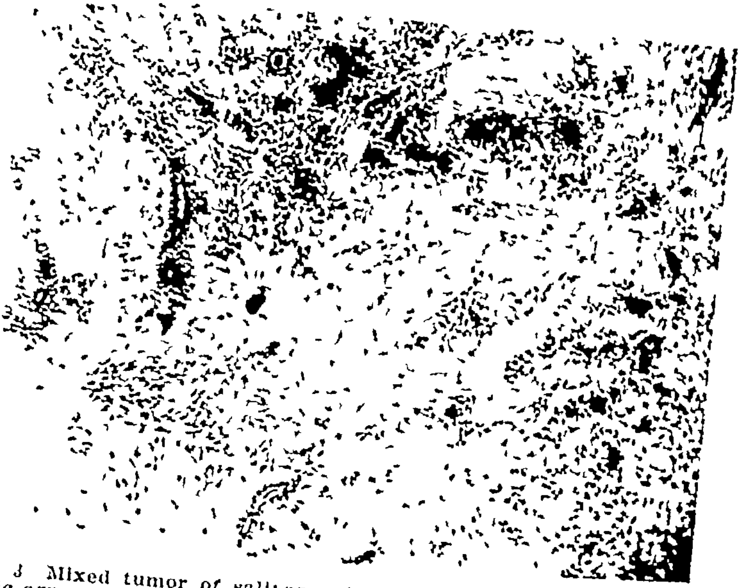


Fig 3 Mixed tumor of salivary gland type Epithelial cells in characteristic arrangement and mucinous ground substance (× 120)

In other instances, mixed salivary tumors can be described as basal-cell carcinomas with hyaline stroma Neoplasms of this type are composed of small, cuboid or spindle-shaped cells, with hyperchromatic nuclei, and arranged in cords or strands which fuse with the hyaline stroma

In a number of salivary gland tumors, the epithelial cells show *cylindromatous* arrangement (see Fig 4) The stroma of the tumor consists of coarse hyaline matter, arranged into more or less parallel bundles between which the cellular and glandular elements are compressed[57] The coarse trabeculae of connective tissue may undergo mucoid degeneration The epithelial cells are small and dark staining, and are arranged in cylinders or plugs which honeycomb the stroma[1] The cellular arrangement resembles to a certain degree the adenocystic type of basal-cell carcinoma

A third group of neoplasms, appearing within the various salivary glands, has been described by Stewart, Foote and Becker[51] as *mucoepidermoid tumors* (see Fig 5) They are characterized by the presence of numerous mucous cells, more

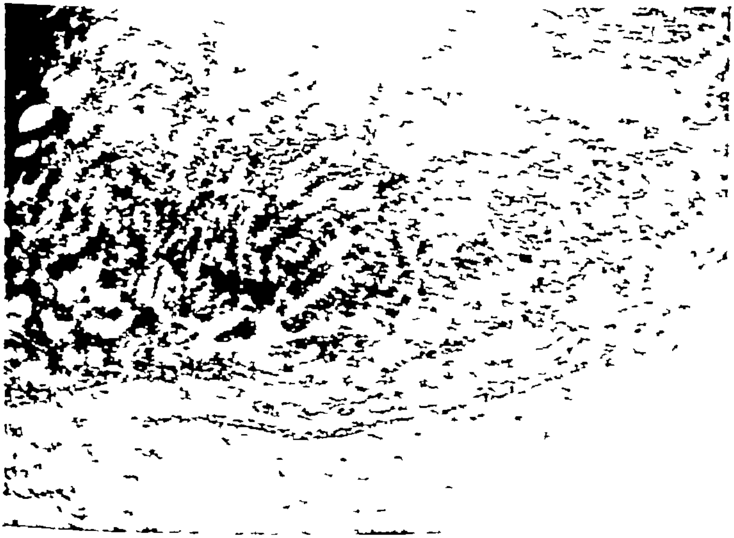


Fig. 4. Mixed tumor of salivary gland type Cylindromatous arrangement of epithelial cells (× 120)

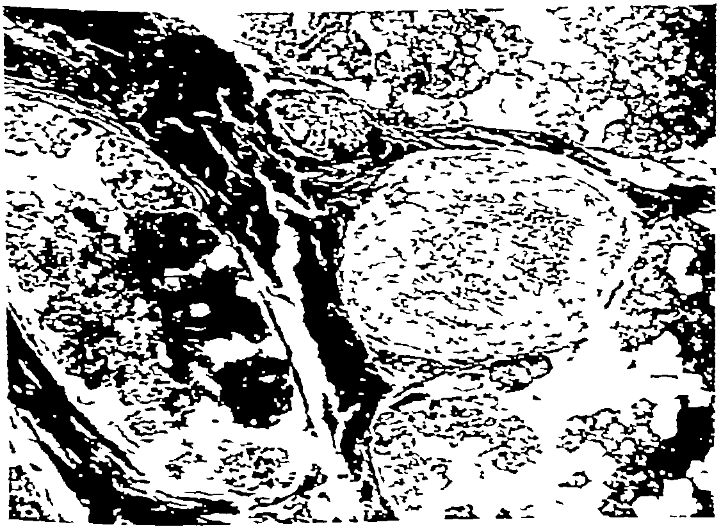


Fig 5 Mucoepidermoid tumor of salivary gland type There is involvement of ducts near the center surrounded by normal glandular tissue (× 120)

frequent in benign than in malignant tumors Sometimes entire areas of the tumor consist chiefly of mucous cells, and epidermoid cells are by no means as plentiful as those of the basal or "intermediate" type One of the outstanding cytologic characteristics is epidermoid metaplasia occurring mainly in basal cells but also observed in mucous and columnar cells

Benign tumors of the mucoepidermoid type are usually marked by pronounced multiplicity of cell types If basal or "intermediate" cells predominate, a uniform mosaic pattern results, leading to a sheet-like arrangement In regions where mucous cells prevail, small or dilated duct-like structures will be observed Such cysts, filled with mucoid secretion ("mucus pools") appear in about 50 per cent of all benign tumors of this type Dilatation of these cysts may take place, as well as erosion of lining epithelium, disruption of the basement membrane, and leakage into adjacent tissue, possibly resulting in necrosis In about one-third of the number of benign tumors, the cells in certain areas are hydropic, swollen and filled with extraordinarily clear cytoplasm Cells of this kind in alveolar or pseudoglandular arrangement simulate renal adenocarcinoma, and Stewart, Foote and Becker[81] report that in one instance this similarity was so pronounced that "it was necessary to have assurance that there was no clinical evidence of renal neoplasm before making the diagnosis of mucoepidermoid salivary gland tumor"

Malignant tumors of the mucoepidermoid type are usually very diffusely overgrown and rather anaplastic Generally epidermoid cells are predominant The almost complete overgrowth of epidermoid or squamous cells gives at times the appearance of unicellular cancer of epidermoid or squamous type Staining with mucicarmine will, however, demonstrate the presence of mucus Malignant mucoepidermoid tumors show little tendency towards the formation of microcysts Mucus pools, due to an overabundant production of mucus are rarely, if ever, observed

CLINICAL FINDINGS

Mixed tumors growing from the palate are as a rule firm and will at times obstruct the pharyngeal opening In all tumors of salivary gland type, differences in consistence are due to variations in the connective tissue and cartilage content In general the rate of growth is slow Tumors of salivary type begin usually as a small submucous nodule, and grow within a capsule On the average, the malignant variant is smaller than the benign tumors, and shows less tendency towards cyst formation Localized pain is more often associated with malignant than with benign tumors and accompanies almost regularly neoplasms of cylindromatous structure Swelling and tenderness are often observed Salivary gland type tumors of the palate sometimes produce hemorrhage, or difficulty of deglutition, tumors of the tongue may lead to speech impairment Most of the patients with tumors in the paranasal sinuses complain of nasal blockage, pain, nose bleed or nasal discharge as first symptoms Tumors originating within the external auditory canal or in the middle ear may lead to impairment of hearing and to Roentgenologicaly demonstrable bony changes Malignant mucoepidermoid tumors often produce mucosal ulceration, as well as erosion and penetration of adjacent bony structures

SEX

A statistical tabulation of the same material as mentioned earlier in this report showed that 489 of the patients with minor salivary gland tumors were males, 192 were females, while in 457 instances the sex of the patient was not indicated

New and Childrey[61] reported 87 7 per cent of male patients in their series of 357 cases In the series of Ahlbom,[3] on the other hand, which includes major as well as minor salivary gland tumors, there occurred a marked predominance of female patients (65 per cent) According to Stewart, Foote and Becker,[81] sex is no factor in mucoepidermoid tumors, and benign as well as malignant neoplasms occurred with approximately equal frequency in male and female patients. It has, however, to be added that total figures of these last named authors also include patients with tumors of the major salivary glands. The remark by Willis[87] seems, therefore, entirely warranted, that there is but little difference between the sexes in their liability to salivary tumors.

AGE

The age of patients was mentioned in only a small number of cases, and the average figure calculated on that basis, 41.2 years, may be of no great statistical value. The extreme ages in this series were 13 and 87 years, respectively. New and Childrey's[60] series with a slightly higher average age (45.5 years) included patients as young as four and as old as 80 years. The average age of Ahlbom's[3] patients with tumors of the minor salivary glands was 47.8 years.

All authors agree that the average age of patients with malignant tumors is considerably higher than that of persons with benign neoplasms. There is no reason why this finding in groups which include tumors of the major as well as the minor salivary glands should not apply also to a series limited to the latter location.

SITE OF PRIMARY LESION

In 414 cases reported in the 82 papers on which the present statistical survey is mainly based, the site of lesion was not sufficiently identified. In the rest of the material, the *palate*, including hard as well as soft palate, was most often the location of the growth. This finding is in agreement with the results of every other published series, and in all instances palatine growths were more abundant than minor salivary gland tumors in any other site, however, in the present tabulation, tumors of the palate were comparatively less frequent than reported in the smaller groups of Willis[87] and Ahlbom. Benign[35] or malignant[60, 58] tumors of the hard palate may invade the paranasal sinuses, or the nasal cavity proper. In other instances, the growth may infiltrate into the *faucial* pillar[26] As squamous cell carcinoma is relatively rare within the hard and soft palate, while tumors of salivary gland type are comparatively frequent, their possible presence should always be taken into consideration in the differential diagnosis of neoplasms encountered in that area (see Table 3)

TABLE 3

Primary Site of Tumors of the Minor Salivary Glands Published During the Past 20 Years Four Additional Cases Two of Which are the Author s Own the Others Obtained Through Personal Communication Have Been Added

Hard and soft palate	264
Nose	84
Pharynx	73
Lip	59
Paranasal sinuses	44
Trachea	41
Tongue	38
Cheek	36
Tonsillar region	18
Floor of mouth	18
Glottic area and larynx	14
External ear canal and middle ear	13
Gums	11
Bronchi	7
Not specified	414
Total number of cases	1 138

Next to the palate, minor salivary gland tumors were most frequently encountered in the *nasal cavity* (84 times) A similarly large percentage of nasal tumors has been reported by McDonald and Havens[54] One tumor of the upper septal region recurred five times within four years, but never proceeded to metastases or local invasion,[10] another case involving the right nasal cavity as well as the floor of the antrum produced four localized recurrences[44]

The mucosa of the *pharynx* was the original site of the tumor in 73 cases In one instance, the growth was so large that it extended from the ear to the thyroid cartilage, several other tumors had eroded cervical vertebrae[60] Origin within or about the Eustachian orifice is especially noted in one instance[41]

Salivary gland tumors of the *lip* were noted in 59 cases, apparently oftener in the upper than in the lower lip

In the *paranasal sinuses* there occurred 44 cases, two-thirds of which are reported by McDonald and Havens[54] Recurrent tumors of the antrum may invade the palate,[7] and as at the same time tumors of the palate may proceed to erosion of adjacent bone,[71] it is sometimes difficult to decide where the complex growth had originated

More than 5 per cent of all minor salivary gland tumors in which the location was sufficiently specified or, to be precise, 41 cases, occurred within the *trachea* This is considerably more than in the larynx and glottic areas, a fact which is confirmed by the observation of Ahlbom[3] The greater number of instances of minor salivary gland tumors within the trachea has been reported by McDonald,[53] who submitted 27 cases from the records of the Mayo Clinic Sixteen of the patients were males, 11 females, the youngest was 29, the oldest 70 years of age Histologically, all tumors were considered to be malignant, though to varying degrees Squamous cell carcinoma was most frequently encountered (11 times), the remainder consisting of cylindromas (eight), adenocarcinomas (six) and hemangioendotheliomas A basalioma of the subglottic-tracheal area, which was classified as "benign," recurred 11 years after excision, and at that time three different growths appeared, causing almost complete obstruction[illegible] Tracheal tumors sometimes attain to a very large size, as for instance an epithelioma adenoides cysticum, which extended from the subglottic region to the point of origin of the right bronchus[31] In other instances, tracheal cylindromas arose close to the bifurcation and proceeded to involve one or both bronchi[illegible]

A survey of the literature shows that salivary gland type tumors were observed 38 times within the mucosa of the *tongue* Fifteen cases were reported by McDonald and Havens,[54] all of which were considered to be malignant The histologic diagnosis was cylindroma in seven instances, adenocarcinoma in six instances, while mixed tumors were noted twice In a series of 11 tumors of salivary gland type within the tongue, Brunschwig[12] found seven neoplasms situated within the base, while in Ahlbom's[3] much smaller series of four cases, all tumors were encountered in this location The great danger of malignant neoplasms arising at that site is well illustrated by a pseudoadenomatous basal cell carcinoma which had developed in a salivary gland at the base of the tongue the tumor spread locally so far as to almost close the right side of the pharynx, while at the same time metastases to the cervical lymph nodes as well as to the lungs and the femur occurred [46]

Salivary gland type tumors of the *cheek* have been reported in 36 instances, the greatest part by McDonald and Havens [54] Their series consists of an equal number of mixed tumors and adenocarcinomas, and of a few cylindromas Attempts have been made to distinguish the buccal glands from which these neoplasms spring, and it may be assumed that the greatest part arises either from the accessory parotid or from the adjacent molar glands

The *tonsillar region* is noted as the origin of salivary gland type tumors in 22 instances Such neoplasms often extend to involve the lateral pharyngeal wall,[28 31] or may reach the base of the epiglottis [59]

The *floor of the mouth* is the region of origin in 18 cases, almost all reported by McDonald and Havens,[54] who found that cylindromas are more numerous than adenocarcinomas or mixed tumors

Salivary gland tumors are rare in *glottic area and larynx* (14 cases) It is noteworthy that neoplasms of this type are most frequently encountered in the subglottic area, near the

The mucosa of the *pharynx* was the original site of the tumor in 73 cases In one instance, the growth was so large that it extended from the ear to the thyroid cartilage, several other tumors had eroded cervical vertebrae[60] Origin within or about the Eustachian orifice is especially noted in one instance[44]

Salivary gland tumors of the *lip* were noted in 59 cases, apparently oftener in the upper than in the lower lip

In the *paranasal sinuses* there occurred 44 cases, two-thirds of which are reported by McDonald and Havens[54] Recurrent tumors of the antrum may invade the palate, and as at the same time tumors of the palate may proceed to erosion of adjacent bone,[71] it is sometimes difficult to decide where the complex growth had originated

More than 5 per cent of all minor salivary gland tumors in which the location was sufficiently specified or, to be precise, 41 cases, occurred within the *trachea* This is considerably more than in the larynx and glottic areas, a fact which is confirmed by the observation of Ahlbom[3] The greater number of instances of minor salivary gland tumors within the trachea has been reported by McDonald,[53] who submitted 27 cases from the records of the Mayo Clinic Sixteen of the patients were males, 11 females, the youngest was 29, the oldest 70 years of age Histologically, all tumors were considered to be malignant, though to varying degrees Squamous cell carcinoma was most frequently encountered (11 times), the remainder consisting of cylindromas (eight), adenocarcinomas (six) and hemangioendotheliomas A basalioma of the subglottic-tracheal area, which was classified as "benign," recurred 11 years after excision, and at that time three different growths appeared, causing almost complete obstruction[5] Tracheal tumors sometimes attain to a very large size, as for instance an epithelioma adenoides cysticum, which extended from the subglottic region to the point of origin of the right bronchus[34] In other instances, tracheal cylindromas arose close to the bifurcation and proceeded to involve one or both bronchi[55]

A survey of the literature shows that salivary gland type tumors were observed 38 times within the mucosa of the *tongue* Fifteen cases were reported by McDonald and Havens,[54] all of which were considered to be malignant The histologic diagnosis was cylindroma in seven instances, adenocarcinoma in six instances, while mixed tumors were noted twice In a series of 11 tumors of salivary gland type within the tongue, Brunschwig[12] found seven neoplasms situated within the base, while in Ahlbom's[3] much smaller series of four cases, all tumors were encountered in this location The great danger of malignant neoplasms arising at that site is well illustrated by a pseudoadenomatous basal cell carcinoma which had developed in a salivary gland at the base of the tongue the tumor spread locally so far as to almost close the right side of the pharynx, while at the same time metastases to the cervical lymph nodes as well as to the lungs and the femur occurred [46]

Salivary gland type tumors of the *cheek* have been reported in 36 instances, the greatest part by McDonald and Havens [54] Their series consists of an equal number of mixed tumors and adenocarcinomas, and of a few cylindromas Attempts have been made to distinguish the buccal glands from which these neoplasms spring, and it may be assumed that the greatest part arises either from the accessory parotid or from the adjacent molar glands

The *tonsillar region* is noted as the origin of salivary gland type tumors in 22 instances Such neoplasms often extend to involve the lateral pharyngeal wall,[28 31] or may reach the base of the epiglottis [89]

The *floor of the mouth* is the region of origin in 18 cases, almost all reported by McDonald and Havens,[54] who found that cylindromas are more numerous than adenocarcinomas or mixed tumors

Salivary gland tumors are rare in *glottic area and larynx* (14 cases) It is noteworthy that neoplasms of this type are most frequently encountered in the subglottic area, near the border of the upper trachea Tumors in this latter location have been classified by Ahlbom[3] as tracheal growths Resulting tracheal obstruction may sometimes simulate asthma[41]

Primary tumors of salivary gland type are so rare within the *ear* that it may be of interest to report the specific origin where they have been recorded in the literature Such neoplasms are most frequent within the external auditory meatus and may even extend into the middle ear[4] One tumor was reported near the opening of the Eustachian tube, another was attached to the inner tympanic wall[13] Salivary gland tumors in the region of the ear are oftentimes pedunculated[33] A granular cell myoblastoma, fixed to the wall of the inner part of the external ear canal, recurred after it had been removed nine times by surgery[4]

Within the oral cavity, tumors of salivary gland type were least frequently observed in the *gums* (11 times) Malignant mucoepidermoid tumors appeared twice in the alveolar ridge[51] A tumor of the angle of the left jaw, variously diagnosed as myxochondroendothelioma, adenocarcinoma or cylindroma, recurred after 29 years[38]

Only seven instances of minor salivary gland tumors of the *bronchi* are on record All these neoplasms were classified as cylindromas, and in some cases the tumor grew to involve the upper lobe of the lung

CASE REPORTS

Case 1 F C male white, age 60 years was first seen on May 5 1915 The patient complained of sore throat and pain radiating to the right side of the face of two days duration He also had a dry hacking cough and pain in the chest Patient had been a pipe smoker for 13 years Examination revealed an old central perforation of the right tympanic membrane The left tympanic membrane was clear The nasal septum showed considerable deviation to the right without however causing great obstruction The nasopharyngeal mucosa was hyperemic but no masses were seen The sinuses appeared clear upon transillumination Leucoplacic areas were discovered in the mucosa of the cheeks and also in soft and hard palate On the left side of the soft palate a firm non-tender nodule was encountered under the mucosa The vocal cords moved normally and there were no masses in the larynx First impression leucoplacia of the mouth tumor of the palate possibly malignant Upon removal on June 26 the tumor was seen to involve the entire left half of the soft palate extending anteriorly to the junction of the soft and hard palate The mass was not too well encapsulated and had to be removed in several pieces. The wound healed per primam and at time of writing there has been no recurrence

The specimen submitted for pathologic examination consisted of a dozen or more irregular pieces of tissue of yellowish mucoid appearance the largest fragment measured 12 x 7 x 10 mm. Microscopic examination showed the neoplasm to be composed of small cells partly undifferentiated and partly of tubular shape Colloid like inclusions were frequently observed within these tubules The undifferentiated cells tended to merge with a myxoid stroma which in some places was of hyaline appearance however tubular or duct like structures predominated, while the stroma was relatively scarce In one area a large duct was surrounded by papillary ridges of stroma in other places the epithelium of ductules tended to infiltrate the deeper layers of connective tissue Parts of several specimens exhibited normal salivary gland structure Most of this tumor appeared to be benign but propensity for recurrence had to be taken into consideration Adenomatous structure predominated within the tumor *Diagnosis* Salivary gland tumor (see Figs 6 and 7)

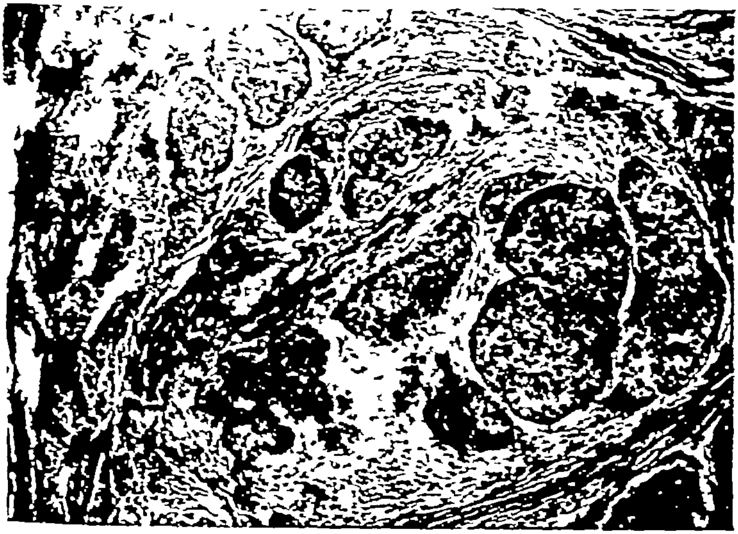


Fig 6 Mixed tumor of the palate Case 1 Alveolar arrangement of cells and myxomatous character of stroma. (× 120)

Case 2 V W female white 43 years of age was first seen on Nov 7 1947 The patient complained of sore throat of two years duration intermittent hoarseness during the past 12 months dyspnea progressively increasing in the course of the past year The patient had been in good health all her life *Physical Examination* Ears nose and upper respiratory passages were normal Mirror examination of the larynx demonstrated two large polypoid granular masses located underneath the left cord in the posterior portion of the larynx. *Initial Impression* Poly

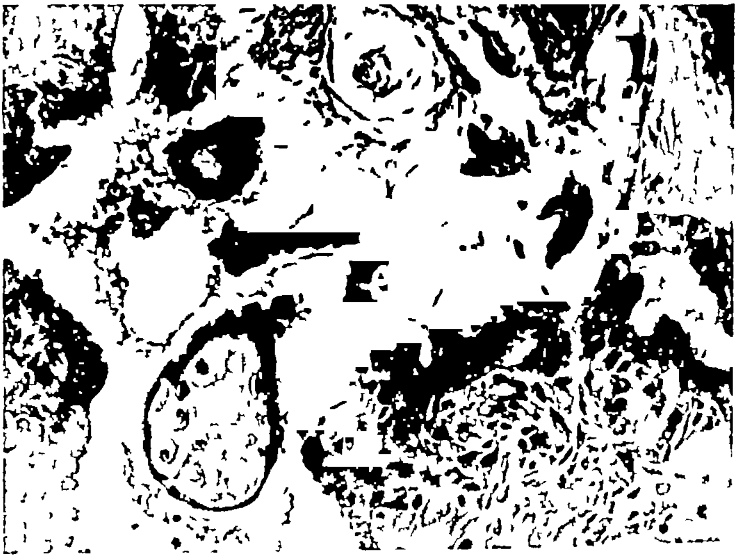


Fig 7 Mixed tumor of the palate Case 1 In the left center cystic degeneration is apparent while in the upper center basal cells with pearl formation are seen (× 210)

poid granuloma of the subglottic region Direct laryngoscopy was performed on the same day and the tumor was removed In addition to the two large polypoid tumors a more sessile accumulation of tissue was encountered, extending to the anterior wall of the larynx in the subglottic region

Direct laryngoscopy was repeated two weeks later at which time the area from which the tumors had been excised was fulgurated Again one week later the larynx was examined and found to be in good condition

Histologic Examination The tumor consisted of gland like spaces often distorted by papillary structures For the most part these spaces were lined by two or more layers of cells, resembling cuboidal epithelium When only two layers were present the epithelium showed fairly orderly arrangement The cytoplasm stained lightly the nuclei took the stain rather evenly while the nucleoli were barely visible There existed hardly any indication of mitotic activity The gland like spaces often contained basophilic material resembling mucin In the tissue spaces between these gland like structures there appeared abundant evidence of proliferation of somewhat different cells These cells were mostly of oval shape but sometimes also stellate and thus similar to the so called undifferentiated cells of mixed tumors, no definite pattern could be recognized in the arrangement of these cells Moderate leucocytic infiltration was noted In some areas there occurred vacuolization of the cytoplasm as evidence in the signet like shape which the nuclei had assumed under compression This appearance was taken to be due either to intracellular mucinous secretion or to degeneration The stroma had the form of elongated twisted cords of hyaline material Two diagnostic possibilities suggested themselves mixed tumor akin to the mixed tumors of salivary gland origin and occasionally seen in the mouth or in portions of the respiratory tract or papillary adenoma of mucous gland origin The first possibility seemed more likely The tumor was considered to be benign but capable of local recurrence and aggressive growth (see Fig. 8)

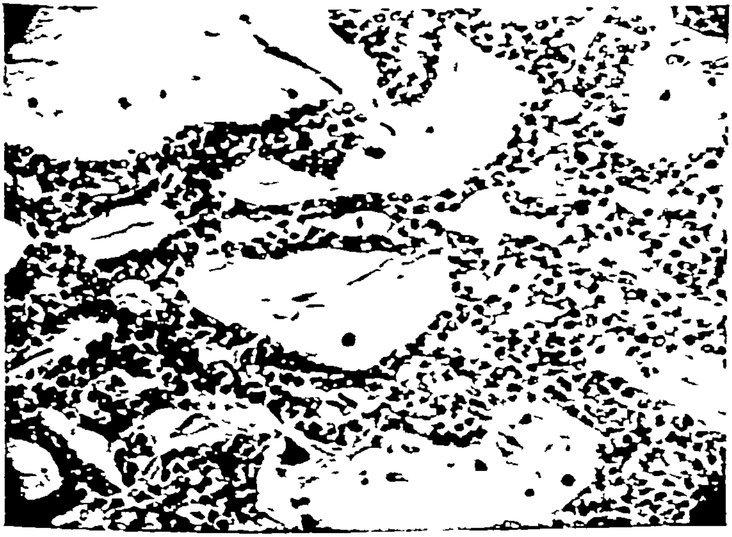


Fig 8 Mixed tumor of the larynx. Case 2 Cylindromatous arrangement of cells can be observed. (× 210)

SUMMARY

Tumors of the minor salivary glands are more frequently encountered than is usually assumed A comprehensive but by no means complete review of the literature of the past 20 years revealed 1,138 published cases History, histological classification and histopathology of minor salivary gland tumore are discussed The clinical characteristics, especially the site of the primary lesion, are reported on the basis of a statistical evaluation of the bibliographic material Two cases are presented and a third one is briefly reviewed, which, though diagnosed as mixed tumor of salivary gland type, was proved at autopsy to have been the metastasis of a hypernephroma.

BIBLIOGRAPHY

1 Abshier, A B Mixed Tumor of Palate *Arch Dermatol and Syphl*, 32 622 625, Oct, 1935

2 Ackerman, L V and Regato, J A. del Cancer Diagnosis Treatment and Prognosis St Louis C V Mosby Co 1947

3 Ahlbom, H E Mucous and Salivary Gland Tumors Stockholm *Acta Radiol*, Supp 23, 1935

4 Altmann, F Granular Cell Myoblastomas of External Auditory Meatus The Laryngoscope, 53 195 202, Mar 1943

5 Barth, H Recurrent Mixed Tumor of Trachea *Ztschr f Hals Nasen u Ohrenh*, 30 583 589, 1932

6 Beck, J C Intrapalatal Mixed Tumor The Laryngoscope, 40 522 524, July, 1930

7 Beck, J C, and Gutman, M R Basiloma or So-called Cylindroma of Air Passages *Ann Otol, Rhinol and Laryngol*, 45 618 631 Sept 1936

8 Blumberg, A, and Terry, G H B Mixed Tumors Involving Hard and Soft Palate *South Med Jour*, 24 333 336, Apr, 1931

9 Boemke, F, and Moritz, W Cylindroma of Trachea *Ztschr f Hals, Nasen u Ohrenh*, 45 228 241, 1939

10 Bredlau, E A Recurrent Basal Cell Carcinoma of Nasal Septum Histogenesis of So-called Cylindromas *Arch Otolaryngol* 20 382 389 Sept, 1934

11 Brown, John MacKenzie Personal communication

12 Brunschwig, A Mixed Tumors of Tongue and Sublingual Gland *Surg Gynec and Obst*, 50 407-415, Feb, 1930

13 Capps, F C W Hemangioendothelioma of Middle Ear *Jour Laryngol and Otol*, 59 342 346 Sept, 1944

14 Carruthers, D G Mixed Tumor of Soft Palate Resembling Mixed Tumors of Parotid Gland *Med Jour Australia*, 2 692 Dec 3 1932

15 Chamberlain, W B Mixed Tumors of Salivary Gland Type Occurring in Soft Palate *Trans Amer Laryngol Rhinol and Otol Soc Inc* 33 175 179, 1927

16 Collins, F M 'Mixed Tumor' of Upper Lip *Brit Med Jour* 1 121 122, Jan 15, 1938

17 Craig D H Tumor of Parotid Type in Tonsillar Region *Jour Laryngol and Otol* 56 11 14, Jan 1941

18 Curr J F Salivary Gland Tumor of Upper Lip *Brit Med Jour* 2 605 Nov 3 1945

19 D Aunoy R Mixed Tumor of Palate *Amer Jour Pathol* 6 13 146, Mar 1930

20 Davis, L J Mixed Tumors of Palate *Jour Pathol and Bacteriol* 41 289 292 Sept, 1935

21 Dockerty, M B, and Mayo, Charles W Primary Tumors of the Submaxillary Gland with Special Reference to Mixed Tumors *Surg Gynec and Obst* 74 1033 1045 June 1942

22 Driver, J R Mixed Tumor of Palate *Arch Dermatol and Syph* 33 73 84 Jan 1936

23 Eggers, H E Mixed Tumor of Palate *Arch Pathol* 6 37 Sept 1928

24 Eggers, H E. Mixed Tumor of Lip *Arch Pathol*, 26 348-353 July, 1938

25 Ersner, M S and Saltzman, M Mixed Tumor of Nasal Septum. The Laryngoscope, 54 287 296 June 1944

26 Evans, W G Mixed Tumor of Palate *Brit Med Jour* 2 1141, Dec. 5 1936

27 Ewing J Neoplastic Diseases Philadelphia W B Saunders Co 1940, 4th ed

28 Fox, C C Mixed Tumors of Salivary Gland Type Seen in Pharynx *Arch Otolaryngol*, 30 73 85 July, 1939

29 Fitch, Charles E Personal communication

30 Gerlings, P G, and Roegholt M N Mixed Tumor of Posterior Wall of Trachea. *Jour Laryngol and Otol*, 54 194-196 Apr 1939

31 Gidoll, S H Mixed Tumor of Soft Palate *Arch Otolaryngol* 38 166-168, Aug 1943

32 Goldsmith, P G and Ireland P E Mixed Tumors in Nose and Throat. *Ann Otol., Rhinol and Laryngol*, 45 940-950 Dec, 1936

33 Gourlay J S Salivary Gland Tumor Situated in Hard Palate *Brit Med Jour*, 2 391 Aug 22 1936

34 Guttman, M R. Primary Adenocystic Carcinoma or Cylindroma of Trachea *Ann Otol, Rhinol and Laryngol* 45 894 901 Sept 1936

35 Halpert, B Salivary Gland Tumors in Rare Sites *Yale Jour Biol and Med*, 5 469-471 May 1933

36 Hamrick, J G and Howe, J S Mixed Tumor of Lip *Arch Pathol* 37 143 146 Feb 1944

37 Hill, F T Mixed Tumor of Hard Palate *Ann Otol, Rhinol and Laryngol*, 47 317-325 June 1938

38 Hoepfel, W Structure and Nature of Mucous Gland Tumors of Palate and Oral Cavity Particularly in Relation to So-called Mixed Tumors of Salivary Glands *Ztschr f Hals Nasen u Ohrenh* 41 52 87 1936

39 Horn R C Jr. and Stout A. P Granular Cell Myoblastoma of External Auditory Canal. *Surg Gynec and Obst* 76 315 318 Mar 1943

40 Howarth, W Mixed Tumor of Trachea *Jour Laryngol and Otol* 54 205-206 Apr 1939

41 Ide. D and Cahn, H L. Subglottic Cylindroma The Laryngoscope, 58 328-335 Apr 1948

42 Jarman, T F Mixed Tumors Arising in Palate *Brit Jour Surg* 22 626-628 Jan 1935

43 Joske E A Mixed Tumor of Palate with Sarcomatous Changes *Med Jour Australia* 2 347 348 Sept 7 1946

44 Kramer R and Som M L. Cylindroma of Upper Air Passages Cylindromatous Type of Mixed Tumor *Arch Otolaryngol* 29 356-370 Feb 1939

45 Layera, J and Orosco G Mixed Tumors in the Soft Palate *Prensa med argent* 15 890-898 Dec 30 1928

46 Lampe, I Pseudoadenomatous Basal Cell Carcinoma of Tongue (Salivary Gland Tumor) *Radiol* 39 54-61 July 1942

47 Lederman M Mucous and Salivary Gland Tumors *Brit Jour Radiol* 14 329, Oct 368 Nov 1941

BIBLIOGRAPHY

1 ABSHIER, A B Mixed Tumor of Palate *Arch Dermatol and Syphl*, 32 622 625, Oct, 1935

2 ACKERMAN, L V and REGATO, J A DEL Cancer Diagnosis Treatment and Prognosis St Louis C V Mosby Co, 1947

3 AHLBOM, H E Mucous and Salivary Gland Tumors Stockholm *Acta Radiol*, Supp 23, 1935

4 ALTMANN, F Granular Cell Myoblastomas of External Auditory Meatus THE LARYNGOSCOPE, 53 195 202, Mar, 1943

5 BARTH, H Recurrent Mixed Tumor of Trachea *Ztschr f Hals Nasen u Ohrenh*, 30 583 589, 1932

6 BECK, J C Intrapalatal Mixed Tumor THE LARYNGOSCOPE 40 522 524 July, 1930

7 BECK, J C, and GUTMAN, M R Basiloma or So-called Cylindroma of Air Passages *Ann Otol, Rhinol and Laryngol*, 45 618 631 Sept 1936

8 BLUMBERG, A, and TERRY, G H B Mixed Tumors Involving Hard and Soft Palate *South Med Jour*, 24 333 336, Apr 1931

9 BOEMKE, F and MORITZ, W Cylindroma of Trachea *Ztschr f Hals, Nasen u Ohrenh*, 45 228 241, 1939

10 BREDLAU, E A Recurrent Basal Cell Carcinoma of Nasal Septum, Histogenesis of So-called Cylindromas *Arch Otolaryngol*, 20 352-359 Sept, 1934

11 BROWN, JOHN MACKENZIE Personal communication

12 BRUNSCHWIG, A Mixed Tumors of Tongue and Sublingual Gland *Surg Gynec and Obst*, 50 407-415 Feb 1930

13 CAPPS, F C W Hemangioendothelioma of Middle Ear *Jour Laryngol and Otol*, 59 342 346 Sept, 1944

14 CARRUTHERS, D G Mixed Tumor of Soft Palate Resembling Mixed Tumors of Parotid Gland *Med Jour Australia* 2 692 Dec 3 1932

15 CHAMBERLAIN, W B Mixed Tumors of Salivary Gland Type Occurring in Soft Palate *Trans Amer Laryngol, Rhinol and Otol Soc Inc* 33 175 179, 1927

16 COLLINS, F M 'Mixed Tumor' of Upper Lip *Brit Med Jour* 1 121 122 Jan 15 1938

17 CRAIG D H Tumor of Parotid Type in Tonsillar Region *Jour Laryngol and Otol*, 56 11 14, Jan, 1941

18 CURR J F Salivary Gland Tumor of Upper Lip *Brit Med Jour* 2 605 Nov 3 1945

19 D'ALNOY R Mixed Tumor of Palate *Amer Jour Pathol* 6 137 146, Mar 1930

20 DAVIS, L J Mixed Tumors of Palate *Jour Pathol and Bacteriol* 41 289 292 Sept, 1935

21 DOCKERTY M B and MAYO CHARLES W Primary Tumors of the Submaxillary Gland with Special Reference to Mixed Tumor *Surg Gynec and Obst* 74 1033 1045 June 1942

22 DRIVER J R Mixed Tumor of Palate *Arch Dermatol and Syph* 33 73 84 Jan, 1936

23 EGGERS H E Mixed Tumor of Palate *Arch Pathol* 6 [illegible] Sept 1928

71 ROBBINS, G F So-called Mixed Tumors of Salivary Gland Origin *Surg*, 14 924 930, Dec 1943

72 ROBILLARD, G L, and CHISENA, F Mixed Tumor of Tongue *Amer Jour Surg*, 43 794-796, Mar, 1939

73 ROSEDALE, R S Mixed Tumor of Palate *Ohio State Med Jour* 39 235-237, Mar, 1943

74 SCHREINER, B F, and MATTICK, W L Study of 66 Cases of Salivary Gland Tumors *Amer Jour Roentgenol* 21 541 546 June 1929

75 SINGLETON, A O Benign and Locally Malignant Tumors of the Salivary Glands *Surg, Gynec and Obst*, 74 569 572 Feb 1942

76 SONNENSCHEIN, R Mixed Tumors in the Soft Palate *Arch Otolaryngol*, 11 137 150 Feb, 1930

77 SOUBIRON N NON, and BIANCHI, A Mixed Tumor of Soft Palate *Rev de Especialid*, 5 1891 1897, Nov, 1930

78 SPRING, K Multiple Occurrence of Mixed Tumors of the Salivary Glands *Arch f klin Chir*, 156 203 211 1929

79 STEIN, I and GESCHICKTER C F Tumors of the Parotid Gland *Arch Surg*, 28 492-526 Mar 1934

80 STEVENSON, H N Mixed Tumors of Nasal Septum *Ann Otol, Rhinol and Laryngol*, 41 563 570 June, 1932

81 STEWART, F W, FOOTE, F W, and BECKER W F Mucoepidermoid Tumors of Salivary Gland *Ann Surg*, 122 820 844 Nov 1945

82 STOUT, A P Tumor Seminar *Tex State Jour Med*, 41 564 597 Mar 1946

83 TITCHE, L L Salivary Gland Tumor of Lip *Ann Otol, Rhinol and Laryngol*, 55 945 947 Dec 1946

84 WARSHAW, D Mixed Tumor of Lip *Med Rec* 154 87 90 Aug 1941

85 WEIDLEIN, I F Mixed Tumor of Nasal Septum. *Ann Otol Rhinol and Laryngol*, 45 574-577 June, 1930

86 WILLIAMS, G Salivary Tumor of Hard Palate *Brit Med Jour* 2 426 Aug 29 1936

87 WILLIS, R A. Pathology of Tumors St Louis C V Mosby Co 1948

88. WOLFE W C and HUBINGER H L Mixed Tumor of Palate *Jour Oral Surg* 1 256-258 July 1943

89 WOODSON B Benign Tumor of Pharyngomaxillary Space and Related Area *Tex State Jour Med* 37 785 788 Apr 1942

90 ZYMBAL W T Histologische und Experimentelle Untersuchungen über die Geschwülste der Speicheldrüsen *Beitr z path Anat* 91 113 193 1933 cited by Willis R A

48 LEMAITRE, F , ARDOIN, G , and LEMAITRE, Y So-called Cylindromas *Acta oto laryngol* , 24 112 125, 1936

49 LIGGETT Mixed Tumor of Soft Palate *N Y State Jour Med* 39 1976 1980, Oct 15, 1939

50 LOKE, K T "Mixed Tumor" of Lip *Brit Med Jour* 1 121 Jan 15 1938

51 LUPO, C W Mixed Tumor of Parotid in Tonsil Area *Trans Amer Laryngol , Rhinol and Otol Soc , Inc* , 48 142 143 1942

52 LYNCH, R C Mixed Tumor of Parotid Type Growing from Posterior Aspect of Thyroid Cartilage *Ann Otol , Rhinol and Laryngol* 38 706 715 Sept , 1929

53 McDONALD, J R Symposium on Tumors of Bronchi and Trachea (Cylindroma) *Proc Staff Meeting, Mayo Clin* , 21 416-426, Oct 30 1946

54 McDONALD, J R , and HAVENS F Z A Study of Malignant Tumors of Glandular Nature Found in the Nose, Throat and Mouth *Surg Clin N Amer* , Mayo Clin No 1087 1104, Aug , 1948

55 McDONALD, J R MOERSCH, H J and TINNEY, W S Cylindroma of Bronchus *Jour Thoracic Surg* , 14 445 453, Dec 1945

56 McFARLAND J Three Hundred Mixed Salivary Tumors of Which 69 Recurred *Surg , Gynec and Obst* , 63 457 468, Oct 1936

57 McFARLAND J The Histopathologic Prognosis of Salivary Gland Mixed Tumors *Amer Jour Med Sci* , 203 502 519 Apr , 1942

58 McFARLAND, J Mysterious Mixed Tumors of Salivary Gland *Surg , Gynec and Obst* 76 23 34 Jan 1943

59 MORCH, P Mixed Paratonsillar Tumor *Acta oto laryngol* 19 77 86 1933

60 NEW G B and CHILDREY J H Tumors of Tonsils and Pharynx Adenocarcinomas of Mixed Tumor Type *Arch Otolaryngol* 14 699 712 Dec 1931

61 NEW, G B and CHILDREY J H Tumors of Tonsils and Pharynx Malignant Tumors Exclusive of Adenocarcinoma of Mixed Tumor Type *Arch Otolaryngol* , 14 713 730 Dec 1931

62 NOVAK, F J , III Salivary Gland Tumor of Middle Ear and Paget's Disease (Osteitis Deformans) of Skull *Arch Otolaryngol* 45 177 182 Apr 1947

63 OMBREDANNE M Mixed Tumor of Soft Palate *Ann d'oto laryngol* 6 486 492, May 1936

64 ONO J Mixed Tumor of Pharynx THE LARYNGOSCOPE 44 71 76 Sept 1934

65 OROSCO G and QUIROGA A Large Mixed Tumor of Middle Turbinate of Nose *Semana med* 1 1598 1603 May 26 1932

66 PERSKY A H Mixed Tumor of Retrotonsillar Space *Arch Otolaryngol* 22 725 732 Dec 1935

67 PILCHER R Mixed Tumor of Lip *Brit Med Jour* 1 967 968 May 8 1937

68 PYTEL A Mixed Tumors of Lip *Wien klin Wchnschr* [illegible] 972 July 29 1932

69 REIN C R and FELDMAN M H Mixed Tumor of Palate *Jour Amer Dent Assn* 23 1310 1312 July 1936

70 RHOADS J E and MACRAY P M JR Recurrence of Mixed Tumor in Soft Palate *Amer Jour Med Sci* 193 389 9 Mar 1937

71 Robbins, G F So-called Mixed Tumors of Salivary Gland Origin *Surg*, 14 924-930, Dec 1943

72 Robillard, G L, and Chisena, F Mixed Tumor of Tongue *Amer Jour Surg*, 43 794-796, Mar 1939

73 Rosedale, R S Mixed Tumor of Palate *Ohio State Med Jour* 39 235-237 Mar 1943

74 Schreiner B F and Mattick, W L Study of 66 Cases of Salivary Gland Tumors *Amer Jour Roentgenol* 21 541 546 June 1929

75 Singleton, A O Benign and Locally Malignant Tumors of the Salivary Glands *Surg, Gynec and Obst*, 74 569 572 Feb 1942

76 Sonnenschein, R Mixed Tumors in the Soft Palate *Arch Otolaryngol*, 11 137 150, Feb 1930

77 Soubiron N Non, and Bianchi, A. Mixed Tumor of Soft Palate *Rev de Especialid* 5 1891 1897 Nov 1930

78 Spring, K Multiple Occurrence of Mixed Tumors of the Salivary Glands *Arch f klin Chir*, 156 203 211 1929

79 Stein, I, and Geschickter C F Tumors of the Parotid Gland *Arch Surg* 28 492 526 Mar 1934

80 Stevenson, H N Mixed Tumors of Nasal Septum *Ann Otol, Rhinol and Laryngol* 41 563 570, June 1932

81 Stewart, F W Foote, F W and Becker W F Mucoepidermoid Tumors of Salivary Gland *Ann Surg* 122 820 844 Nov 1945

82 Stout A. P Tumor Seminar *Tex State Jour Med* 41 564 597 Mar 1946

83 Titche, L L Salivary Gland Tumor of Lip *Ann Otol Rhinol and Laryngol*, 55 945 947 Dec 1946

84 Warshaw, D Mixed Tumor of Lip *Med Rec* 154 87 90 Aug 1941

85 Weidlein, I F Mixed Tumor of Nasal Septum. *Ann Otol Rhinol and Laryngol*, 45 574-577 June 1930

86 Williams, G Salivary Tumor of Hard Palate *Brit Med Jour* 2 426 Aug 29 1936

87 Willis R A Pathology of Tumors St Louis C V Mosby Co 1948

88 Wolfe, W C and Hubinger H L Mixed Tumor of Palate *Jour Oral Surg* 1 256-258 July 1943

89 Woodson B Benign Tumor of Pharyngomaxillary Space and Related Area *Tex State Jour Med* 37 785 788 Apr 1942

90 Zymbal W T Histologische und Experimentelle Untersuchungen über die Geschwülste der Speicheldrüsen *Beitr z path Anat* 91 113 193 1933 cited by Willis R A[87]

48 Lemaitre, F, Ardoin, G, and Lemaitre, Y So-called Cylindromas *Acta oto laryngol*, 24 112 125, 1936

49 Liggett Mixed Tumor of Soft Palate *N Y State Jour Med* 39 1976 1980, Oct 15, 1939

50 Loke, K T "Mixed Tumor" of Lip *Brit Med Jour*, 1 121 Jan 15, 1938

51 Lupo, C W Mixed Tumor of Parotid in Tonsil Area *Trans Amer Laryngol, Rhinol and Otol Soc, Inc*, 48 112 143, 1942

52 Lynch, R C Mixed Tumor of Parotid Type Growing from Posterior Aspect of Thyroid Cartilage *Ann Otol, Rhinol and Laryngol* 38 706 715 Sept, 1929

53 McDonald, J R Symposium on Tumors of Bronchi and Trachea (Cylindroma) *Proc Staff Meeting, Mayo Clin*, 21 416-426, Oct 30 1946

54 McDonald, J R, and Havens F Z A Study of Malignant Tumors of Glandular Nature Found in the Nose, Throat and Mouth *Surg Clin N Amer*, Mayo Clin No 1087 1104, Aug, 1948

55 McDonald, J R, Moersch, H J, and Tinney, W S Cylindroma of Bronchus *Jour Thoracic Surg*, 14 445 453, Dec, 1945

56 McFarland, J Three Hundred Mixed Salivary Tumors of Which 69 Recurred *Surg, Gynec and Obst*, 63 457 468, Oct, 1936

57 McFarland, J The Histopathologic Prognosis of Salivary Gland Mixed Tumors *Amer Jour Med Sci*, 203 502 519 Apr, 1942

58 McFarland, J Mysterious Mixed Tumors of Salivary Gland *Surg, Gynec and Obst*, 76 23 34, Jan 1943

59 Morch, P Mixed Paratonsillar Tumor *Acta oto laryngol*, 19 7 86 1933

60 New G B, and Childrey, J H Tumors of Tonsils and Pharynx, Adenocarcinomas of Mixed Tumor Type *Arch Otolaryngol* 14 699 712 Dec, 1931

61 New, G B and Childrey, J H Tumors of Tonsils and Pharynx Malignant Tumors Exclusive of Adenocarcinoma of Mixed Tumor Type *Arch Otolaryngol*, 14 713 730, Dec 1931

62 Novak, F J, III Salivary Gland Tumor of Middle Ear and Paget's Disease (Osteitis Deformans) of Skull *Arch Otolaryngol* 45 477 482 Apr 1947

63 Ombredanne M Mixed Tumor of Soft Palate *Ann d'oto laryngol* 6 486 492, May, 1936

64 Ono J Mixed Tumor of Pharynx The Laryngoscope 44 71 717 Sept, 1934

65 Orosco G, and Quiroga, A Large Mixed Tumor of Middle Turbinate of Nose *Semana med* 1 1598 1603 May 26 1932

66 Persky, A H Mixed Tumor of Retrotonsillar Space *Arch Otolaryngol* 22 725 732 Dec 1935

67 Pilcher R Mixed Tumor of Lip *Brit Med Jour* 1 967 968 May 8 1937

68 Pytel A Mixed Tumors of Lip *Wien klin Wchnschr* 45 971 972 July 29 1932

69 Rein C R and Feldman M H Mixed Tumor of Palate *Jour Amer Dent Assn* 23 1310 1312 July, 1936

70 Rhoads J E and Mackay P M Jr Recurrence of Mixed T in Soft Palate *Amer Jour Med Sci* 193 389 393 Mar 19

cant The performance of mastoidectomy, with successful result, by Petit, in 1760, gave considerable impetus to the lagging interest of the day Paracentesis of the eardrum, to relieve deafness, performed in 1788 by Cooper, of England, did not accomplish its mission, but it did help to focus attention on the eardrum and the middle ear In the latter part of the eighteenth century a serious setback was experienced when mastoidectomy, performed for the relief of tinnitus and deafness, resulted in the death of the royal physician to the Danish King It was not until the decade 1860-1870 that surgical drainage of the mastoid process was placed on a definite acceptable plane by the brilliant efforts of von Troltsch, Lucke and Follin The actual origin of present day mastoid surgery should probably be credited to France While its early development was fostered by Germany and Holland, its latter day growth was encouraged by the work of the Englishmen, Wilde and Toynbee, and its twentieth century improvements have been largely the result of American ingenuity

In 1873, mastoidectomy was first specifically recommended as the treatment for suppuration in the temporal bone Schwartze described the operation and gave the indications for its use His description became the accepted standard until 1905, when Whiting published his classical work In 1910, Reik introduced the blood clot method of healing of the postauricular wound, closing the postauricular soft tissues tightly This method fell into disrepute because of frequent infection of the blood clot with no available drainage Since then the teachings and publications of such men as McKernon, Kerrison, Phillips, Rae, Dench, Duel, Coates and many others have added greatly to the development of surgical technique in the treatment of mastoid suppuration The most recent contributions have been offered by Lempert and his followers in the perfection of the endaural approach to the mastoid

The endaural attack on the temporal bone was attempted many years ago, but the incisions were usually made through skin, fibrous tissue and cartilage indiscriminately, so that considerable postoperative atresia and adhesions were likely to

ENDAURAL SURGERY OF THE TEMPORAL BONE*

REAR ADMIRAL C A SWANSON, M C , U S Navy,
The Surgeon General,
Washington, D C

For the past three years the endaural technique, as outlined by Lempert,[1-] has been used exclusively in all temporal bone surgery at the Bethesda Naval Hospital, with which I have been closely associated in the capacity of consultant in otolaryngology During this period there have been over 100 major operations performed by the endaural method, including complete mastoidectomies (simple mastoidectomy), atticomastoidectomies (modified radical mastoidectomy), tympanomastoidectomies (radical mastoidectomy), resection of osteoma *of the external auditory canal adjacent to* the drum, repair to the facial nerve, repair of postauricular defects, and fenestrations of the external semicircular canal for otosclerosis In all of these procedures, the technique of Lempert has been followed meticulously It is my purpose to review briefly the development of the technique and to outline some of its advantages and disadvantages

The development of temporal bone surgery has proceeded *very slowly* since Riolan,[18] in 1649, recommended opening the mastoid process to relieve deafness caused by Eustachian tube destruction Little enthusiasm developed for this procedure, and very little progress was made for over a century Certain events maintained interest in otologic surgery, however, and their importance must not be lightly dismissed The catheterization of the Eustachian tube, in 1721, *by Guyot* was signifi cant. The performance of mastoidectomy, with successful result, by Petit, in 1760, gave considerable impetus to the lagging interest of the day Paracentesis of the eardrum, to relieve deafness, performed in 1788 by Cooper, of England, did not accomplish its mission, but it did help to focus attention on the eardrum and the middle ear In the latter part of the eighteenth century a serious setback was experienced when mastoidectomy, performed for the relief of tinnitus and deafness, resulted in the death of the royal physician to the Danish King It was not until the decade 1860-1870 that surgical drainage of the mastoid process was placed on a definite acceptable plane by the brilliant efforts of von Troltsch, Lucke and Follin The actual origin of present day mastoid surgery should probably be credited to France While its early development was fostered by Germany and Holland, its latter day growth was encouraged by the work of the Englishmen, Wilde and Toynbee, and its twentieth century improvements have been largely the result of American ingenuity

---

*Presented as Candidate's Thesis to American Laryngological Rhinological and Otological Society Inc 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 21 1949

In 1873, mastoidectomy was first specifically recommended as the treatment for suppuration in the temporal bone Schwartze described the operation and gave the indications for its use His description became the accepted standard until 1905, when Whiting published his classical work. In 1910, Reik introduced the blood clot method of healing of the postauricular wound, closing the postauricular soft tissues tightly This method fell into disrepute because of frequent infection of the blood clot with no available drainage Since then the teachings and publications of such men as McKernon, Kerrison, Phillips, Rae, Dench, Duel, Coates and many others have added greatly to the development of surgical technique in the treatment of mastoid suppuration The most recent contributions have been offered by Lempert and his followers in the perfection of the endaural approach to the mastoid

The endaural attack on the temporal bone was attempted many years ago, but the incisions were usually made through skin, fibrous tissue and cartilage indiscriminately, so that considerable postoperative atresia and adhesions were likely to develop In 1875, several papers were written on the endaural approach to the middle ear and auditory ossicles for the relief of deafness and tinnitus Kessel, of Jena, was a pioneer in this work He was followed by Schwartze, Schroeder, Panse and Jack In 1887, Stacke attacked the endaural approach because he felt it allowed only a small field of operation Improvements in endaural technique were gradually evolved by Kessel, who was able to remove the entire lateral wall of the attic with burr and curette in the last decade of the nineteenth century In 1900, Gompertz reported on the use of local anesthesia in endaural operations In 1901, von Eicken improved local anesthesia by adding adrenalin to the anesthetic agent Thies performed the first radical mastoidectomy by the endaural method in 1907 Essen reviewed the endaural work of Thies and, in 1921, published his own findings and modifications

In 1926, Dr Julius Lempert, of New York, who had performed 1,500 mastoidectomies by the postauricular method of Schwartze, began to use the endaural approach to the temporal bone His classical incisions in the extracartilaginous portions of the external auditory canal are the result of much trial and error experimentation on the cadaver over a period of years By devoting his entire time to the perfection of the endaural method of otologic surgery, Lempert[1] has been able to evolve his three simple incisions that are now so well known By removing a small triangle of the skin and subcutaneous tissues enclosed in these incisions and mobilizing the antauricular window which is thereby produced, it is possible to gain access to any portion of the temporal bone that requires surgical treatment Several modifications of the endaural incisions have been suggested by Shambaugh[11, 1] and others for various reasons

The advantages of the endaural approach can be fully shared only by those who learn all of the technical minutiae that have been developed Preliminary instruction on the cadaver under competent supervision is one of the first requirements A knowledge of the minute anatomy of the tem poral bone and its relations are an acknowledged prerequisite The use of intense illumination provided by an approved type of headlight is important Adequate irrigation and suction apparatus is necessary to maintain a clear operative field Magnification is essential for appropriate treatment of disease in the middle ear and for the creation of fenestra in the semicircular canal The use of sharp cutting burrs in removing the mastoid cortex probably eliminates a good deal of the trauma to the brain which could be produced by mallet and gouge, while it allows greater accuracy in performing this step of the operation The emphasis placed on the use of long-handled sharp curettes as delicate cutting instruments rather than as scoops makes for greater precision in operating, however, the special technique can be mastered only after giving it considerable study and effort, and a rather generous expenditure of money is required for the highly specialized equipment

To justify the extra time and expense required to learn the endaural technique, there are certain advantages which it offers over the postauricular method of attack

1 It affords the most direct avenue of surgical attack on the external auditory canal, mastoid antrum and cells, aditus and epitympanum, labyrinth, zygomatic area, middle ear, facial nerve, lateral sinus, dura of middle and posterior fossae, and the petrous apex

2 There is less trauma to the soft parts

3 There is no postoperative perichondritis or myostitis, if the incisions are properly made

4 Postoperative inspection of the mastoid cavity is facilitated, and treatments are simplified

5 Excellent drainage is maintained for as long as is necessary

6 The postoperative period of disability is shortened

7 The cosmetic scar is minimal

develop In 1875, several papers were written on the endaural approach to the middle ear and auditory ossicles for the relief of deafness and tinnitus Kessel, of Jena, was a pioneer in this work He was followed by Schwartze, Schroeder, Panse and Jack In 1887, Stacke attacked the endaural approach because he felt it allowed only a small field of operation Improvements in endaural technique were gradually evolved by Kessel, who was able to remove the entire lateral wall of the attic with burr and curette in the last decade of the nineteenth century In 1900, Gompertz reported on the use of local anesthesia in endaural operations In 1901, von Eicken improved local anesthesia by adding adrenalin to the anesthetic agent Thies performed the first radical mastoidectomy by the endaural method in 1907 Essen reviewed the endaural work of Thies and, in 1921, published his own findings and modifications

In 1926, Dr Julius Lempert, of New York, who had performed 1,500 mastoidectomies by the postauricular method of Schwartze, began to use the endaural approach to the temporal bone His classical incisions in the extracartilaginous portions of the external auditory canal are the result of much trial and error experimentation on the cadaver over a period of years By devoting his entire time to the perfection of the endaural method of otologic surgery, Lempert[1] has been able to evolve his three simple incisions that are now so well known By removing a small triangle of the skin and subcutaneous tissues enclosed in these incisions and mobilizing the antauricular window which is thereby produced, it is possible to gain access to any portion of the temporal bone that requires surgical treatment Several modifications of the endaural incisions have been suggested by Shambaugh[11, 1] and others for various reasons

The advantages of the endaural approach can be fully shared only by those who learn all of the technical minutiae that have been developed Preliminary instruction on the cadaver under competent supervision is one of the first requirements A knowledge of the minute anatomy of the tem poral bone and its relations are an acknowledged prerequisite The use of intense illumination provided by an approved type of headlight is important Adequate irrigation and suction apparatus is necessary to maintain a clear operative field Magnification is essential for appropriate treatment of disease in the middle ear and for the creation of fenestra in the semicircular canal The use of sharp cutting burrs in removing the mastoid cortex probably eliminates a good deal of the trauma to the brain which could be produced by mallet and gouge, while it allows greater accuracy in performing this step of the operation The emphasis placed on the use of long-handled sharp curretes as delicate cutting instruments rather than as scoops makes for greater precision in operating, however, the special technique can be mastered only after giving it considerable study and effort, and a rather generous expenditure of money is required for the highly specialized equipment

To justify the extra time and expense required to learn the endaural technique, there are certain advantages which it offers over the postauricular method of attack

1 It affords the most direct avenue of surgical attack on the external auditory canal, mastoid antrum and cells, aditus and epitympanum, labyrinth, zygomatic area, middle ear, facial nerve, lateral sinus, dura of middle and posterior fossae, and the petrous apex

2 There is less trauma to the soft parts

3 There is no postoperative perichondritis or myostitis, if the incisions are properly made

4 Postoperative inspection of the mastoid cavity is facilitated, and treatments are simplified

5 Excellent drainage is maintained for as long as is necessary

6 The postoperative period of disability is shortened.

7 The cosmetic scar is minimal

There is a certain feeling of accomplishment enjoyed the otologist who has performed a tympanomastoidectom through the endaural incisions, using electrically driven bur and sharp curettes The gradual uncovering of each lan mark of importance, the systematic eradication of every po sible area of necrosis and infection, and the ease with whic one can convert a mastoidectomy into an atticomastoidectom or a tympanomastoidectomy, or further into a labyrinthectom or apicectomy, all combine to give the surgeon a profoun feeling of satisfaction in the execution of his surgery

In teaching the endaural technique to residents it has bee gratifying to watch their evolution from timid scratchers o the cortex to confident operators, who are not afraid to explor any area once they know its contents and can see its deepest recesses No effort is made to develop speed, and safety is made to depend solely on an intimate knowledge of the anatomy of the part Each resident is shown the postauricular method on the cadaver, but none of them have shown any *inclination to prefer* this method over the antauricular approach The classical Schwartze tympanomastoidectomy (radical) is performed at least once during the year with gouges, rongeurs, chisels and standard curettes by every resident, after he has learned the endaural technique thoroughly This is done because the special equipment normally used in endaural surgery is not available in all naval hospitals and hospital ships

A detailed account of all cases operated upon by the endaural method is not called for in a presentation of this kind It is sufficient to state that there were in all two complete mastoidectomies (simple), 11 atticomastoidectomies (modified radical), over 50 typanomastoidectomies (radical), 50 fenestrations of the labyrinth for otosclerosis, three revisions of fenestrations, and two resections of osteoma of the bony external auditory canal for atresia, included among the endaural procedures performed during the past three years As the experience of the operator increased in each instance his ability increased and his surgical horizon broadened, so that more and more conditions in the temporal bone became readily accessible through the endaural approach With increased ability, there was a noticeable reduction in troublesome bleeding, a much wider exposure of the working area could be obtained as needed, and the postoperative course became much smoother for the patient

Complications following endaural procedures have been very few There have been three temporary facial palsies, one apparently caused by tight packing over a skin graft on the lowered facial ridge, and two caused by lowering the facial ridge too far with a cutting burr The heat of the burr probably caused the paresis All three cases recovered Our greatest difficulty has been experienced in controlling exuberant granulations in the middle ear until epithelial ingrowth could occur following tympanomastoidectomy The judicious use of split thickness skin grafts helps to overcome this We are still troubled by our inability to cope adequately with necrotic granulations covering the stapes in the oval window, and concealing the niche of the round window It is possible that removal of this necrotic tissue would allow improvement in hearing, but the risk involved in working over the stapes is too great The accidental removal of the stapes during an attempt to tease necrotic tissue out of the posterosuperior portion of the middle ear had a dampening effect on our early enthusiasm for the removal of all diseased tissue regardless of its location Too much zeal in curetting granulations out of the hypotympanum resulted in brisk oozing from the jugular bulb in another early case Surprisingly enough, neither of these accidents caused any change in the usual postoperative course, probably because penicillin chemotherapy was employed for 10 days postoperatively Increasing familiarity with the appearance of the middle ear in various pathological conditions has precluded any untoward accidents in the past 50 cases

During this modern era in the history of otologic surgery, when chemotherapy has reduced the incidence of surgical mastoiditis to the lowest percentage it has ever attained, it becomes doubly necessary to train the younger otologists thoroughly in temporal bone surgery during their residency years, since it is likely that their opportunities to keep their hands in operative surgery will be few and far between after they finish their training It is my opinion that the best training can be offered through the teaching of the endaural technique, since the primary requirement for learning the method is a thorough knowledge of the anatomy of the temporal bone

The second part of this paper is being devoted to a discussion of the original 25 cases of clinical otosclerosis which were operated upon at the Bethesda Naval Hospital between April, 1946, and July, 1947 The presentation of the poor early results from this type of aural rehabilitation surgery may cause a stir of disapproval among my more conservative colleagues in otology, but, on the other hand, it can also be used as a measuring stick by those who have not yet attempted this type of surgery For the average *otologic surgeon, the marvelous results obtained in selected cases* at the larger clinics by such outstanding men as Lempert, Shambaugh and House are probably not attainable In a moderately busy practice there will not be more than 300 cases of surgical clinical otosclerosis available in the entire life span of the practicing otologist In such a small series, there cannot be too many disappointments, or the surgeon will soon become discouraged and will abandon the procedure because of the unfavorable publicity it gives him in his community It may be encouraging, therefore, to discuss the trials and tribulations encountered in my early experience with otosclerosis surgery so that the mistakes will not be repeated by others The operation is now so well established and accepted as the only definitive approach to practical rehabilitation in stapes fixation deafness that it behooves all otologists to become familiar with the technique, regardless of the disappointments experienced in some of the first few cases Perhaps the publishing of the results in this small series of operated cases will serve as a stimulus to those whose early experiences have been anything but pleasant and who are ready to abandon the procedure Keeping in mind the old adage that "misery loves company," I will offer the results of my early endeavors as a weeping wall for the faltering fenestrators whose enthusiasm has been badly dampened by a comparison of their results with the published results of the brilliant leaders in the work.

The diagnosis of otosclerosis was made in each of our operated cases on the basis of family history, absence of history of otorrhea, progressive hearing loss with no obvious cause, such as nasal or nasopharyngeal pathology, conduction type of deafness, and normal otoscopic and X-ray Good bone conduction was a necessary requirement but losses up to 30 db were considered within the acceptable limits in the early cases At the present time, a loss of 20 or more decibels by bone for the speech frequencies is considered an unfavorable omen Soon after starting the work, it became apparent that postoperative hearing gains were sometimes delayed beyond the two or three-week period, even though an excellent reception of a low whisper was obtained on the table Considerable anxiety on the part of patient and surgeon was acquired, and no time limit was set for the clinical improvement to occur Reliance had to be placed on the findings during operation, the observed hearing improvement on the table, and the knowledge that all accepted technical steps had been followed in some cases a considerable pure tone audiometric improvement could be shown, but a practical improvement in hearing for conversational voice was not obtained This disappointing finding forced us to adopt the routine preoperative testing of speech intelligibility following the advice of Meltzer This test helps to eliminate from consideration those patients who can "hear but can't understand" If speech intelligibility cannot be improved at any intensity prior to operation, then surgery will not be of much help

Considerable confusion was caused during the early days of this work by the patient whose responses seemed too good to be true I refer to those patients with a conductive type of loss in excess of 45 db by air in both ears, whose bone conduction curve was normal prior to the operation The poorer hearing ear by air conduction would be selected for surgery, providing the masked bone conduction was good, and in a fair number of cases the postoperative gain was substantia by audiometry and amazingly good subjectively The tremendous subjective improvement in one or two such cases aroused our suspicions concerning the validity of the preoperative audiograms Careful rechecking revealed improvement in the unoperated as well as the operated ear, forcing us to conclude that the patient's anxiety for surgery had caused him to give unreliable preoperative hearing curves This led to the development of a higher index of suspicion in the mind of the examiner when any preoperative hearing curve was "too typical to be true" In such cases the facilities of the nearby Forest Glen Aural Rehabilitation Center of the U S Army were made use of, and the malingering tests of Gloig were applied to eliminate the overanxious patient whose hearing level was better than he would admit It has been my experience that persons who are impressed with their hearing loss, and who have been told by competent otologists that they are not yet sufficiently hard of hearing to require fenestration surgery, have a tendency to exaggerate their hearing loss by audiometry in the speech frequencies This type of patient has apparently made up his mind that the only thing that will help him is a fenestration operation, and he continues to make the rounds of the various otologists who do this type of surgery until he can convince one that his hearing loss is of the type that can be benefited by fenestration Operating such a patient leads to nothing but grief The postoperative result in the operated ear is poor, but the unoperated ear may show a hearing gain up to the 30 db level in the speech frequencies It is only after he has operated upon one of these patients that the neophyte in fenestration surgery learns that the hard-of-hearing patient is an excellent salesman who occasionally deceives his otologist about the severity of his hearing loss By the same process the ophthalmologist of limited experience may learn to his sorrow that the unoperated eye of his cataract patient, which could see no better than 20/100 before operation, is able to see 20/30 postoperatively, whereas the best corrected vision of the operated eye is 20/10 Such experiences with patients who are anxious to be operated upon cause the surgeon to become more and more cautious in selecting his cases for surgical treatment

As we have gained greater experience in the surgical treatment of otosclerosis, it has become apparent to us that the most important phase of our work is the preoperative evaluation of the patient No reliance can be placed on a test of bone conduction unless adequate masking is used At least two audiometers must be available for testing purposes so that one can be sent out for standardization at regular intervals. An audiometer cannot be sent through the usual shipping channels without great hazard If at all possible, the machine should be delivered by reliable messenger to the repair station If this cannot be done, the audiometer should be checked, after being repaired, against known normals as soon as it is returned to the otologist Our audiometers have been found to be 15 to 20 db off, in certain frequencies, immediately following their return from the factory

In using the modern audiometer, it is advisable to note the limits of intensity advised by the manufacturer for the various frequencies The small numbers embossed on the dial under the designation of the frequency being tested is the limit beyond which it is useless to go For instance, under the 4096 frequency the small number 80 should be heeded, so that we will not turn the intensity indicator beyond 80, if the machine is well calibrated Some patients will fail to indicate that they hear this frequency until an intensity of 90 db is reached, but if we place the receiver against our own ear we can detect no difference in reception of the tone after the level of 80 db has been exceeded

Tuning forks of good quality should always be standardized by the otologist himself on known normals before they are used for the quantitative diagnosis of deafness In our hands, tuning forks have been relied upon chiefly for a qualitative diagnosis of the type of hearing loss As a routine we employ the Weber, Rinne, Bonier, Schwabach and Gelle tests We have found that little reliance can be placed on the Gellé test for determining whether or not stapes fixation has occurred Apparently many degrees of stapes fixation can exist in otosclerosis

With these preliminary remarks as an introduction, we will offer pre- and postoperative findings in our first 25 cases of surgical otosclerosis

Case 1 Our first fenestration operation was performed on April 21 1946 on a 28 year old white male petty officer who had first noted hearing loss three or four years previously while in battle in the South Pacific Preoperative audiograms revealed an average loss of 38 3 db for the three speech frequencies by air and of 8 3 db by bone in the poorer ear On the table he heard a low whisper at 10 feet but the postoperative audiogram on the operated ear had dropped to an average loss of 18 3 db by air for the speech frequencies at the time of discharge from the service, June 1 1946

Case 2 D L, 22 year-old white male petty officer U S Navy complained of bilateral hearing loss and tinnitus, first noted in combat two years previously Preoperative audiograms revealed an average loss of 56 6 db by air and of 16 6 db by bone for the poorer ear On the table he heard a low whisper at 10 feet, but the postoperative audiograms had shown a drop to an average loss of 48 3 db for the speech frequencies four months later at the time of discharge from the service While this represents an improvement on paper, it must be classified as an unsuccessful result from a practical point of view

Case 3 M L, 25 year-old, white female petty officer, U S Navy first noted bilateral hearing loss and tinnitus two years previously She had never been exposed to a noisy environment Her preoperative audiograms revealed an average loss of 41 6 db by air and of 13 3 db by bone for the critical speech frequencies Speech reception was good for low whisper on the operating table and her postoperative audiograms at discharge in August 1946 showed an average loss of 15 db by air for the speech frequencies showing an average improvement of 26 db and allowing serviceable practical hearing This case was our first successful one and brought the percentage of successful results from zero up to 33

Case 4 A 23 year-old, white male petty officer of the U S Coast Guard had first noted bilateral hearing loss and tinnitus four years previously during exposure to gunfire His preoperative audiograms showed an average loss of 55 db by air and 13 3 db by bone for the speech frequencies A low whisper was heard on the operating table and the first postoperative audiograms revealed an average loss of 31 6 db for the speech frequencies showing a gain of better than 20 db This gain slowly receded to the extent that an audiogram taken two months post operatively showed an average loss of 38 3 db for the speech frequencies and at discharge three months postoperatively, the hearing loss for speech had returned to the preoperative level

Case 5 H G navy nurse aged 30 first noted bilateral hearing loss and unilateral tinnitus at age of 27 Preoperative audiograms revealed an average loss of 40 db by air and of 8 3 db by bone for the speech frequencies in the worse ear A low whisper was heard at 10 feet on the operating table. Postoperative audiograms revealed an average loss of 23.3 db. by air for the operated ear showing a gain of 16.7 db. This gain had been maintained up to November 1948.

Case 6. Mrs. E. G. white 32-year-old wife of an enlisted man U. S. Navy first noted bilateral hearing loss three years previously. Preoperative audiograms revealed an average loss of 46.6 db. by air and of 20 db. by bone for the speech frequencies in the poorer ear. There was a 30 db. loss by bone for the 2048 frequency and a 40 db. loss by bone for the 4096 frequency. On the operating table a low whisper was heard but postoperative audiograms at the time of discharge showed an average loss of 50 db. by air for the speech frequencies. The 2048 frequency had dropped to 55 db., and speech reception was poorer than before operation.

Case 7. J. C., 18-year-old white seaman, U. S. Navy first noted hearing loss at age 15. Preoperative audiogram revealed an average loss of 46.6 db. by air and of 10 db. by bone for the speech frequencies in the poorer ear. Postoperative audiograms revealed an average loss of 25 db. by air for the speech frequencies in the operated ear representing an average gain of 21.6 db., at the time of return to duty two months postoperatively.

Case 8. D. L., white male 22-year-old ships cook U. S. Navy first noticed hearing loss at age 20 while exposed to gunfire. Preoperative audiograms revealed an average loss of 56.6 db. by air and of 16.6 db. by bone for the speech frequencies. Postoperative audiograms at first showed substantial gains but at the time of discharge from the service four months later the average loss had receded to 48.3 db. by air indicating a poor result for all practical purposes.

Case 9. W. S. white male 22-year-old technical sergeant U. S. Marine Corps, had first noticed hearing loss and tinnitus at age 18. Preoperative audiograms revealed an average loss of 48.3 db. by air and of 6.6 db. by bone for the speech frequencies in the poorer ear. Postoperative audiograms at the time of return to duty revealed an average loss by air of 18.1 db. for the speech frequencies in the operated ear representing a gain of 30 db.

Case 10. J. G., white male 18-year-old seaman U. S. Navy first noted hearing loss and tinnitus at age 15. Preoperative audiograms revealed an average loss of 35 db. by air and of 5 db. by bone for the speech frequencies in the right ear with similar loss for air in the left but with poorer bone conduction in the left ear. This patient revealed a promontory blush on otoscopy and his speech reception was poorer than his audiometric loss would indicate. At operation however a low whisper was understood after the fenestra had been created and postoperative audiograms were satisfactory revealing an average loss of 21.6 db. by air for the speech frequencies at the time of return to duty two months later.

Case 11. E. Z., white male 31-year-old private U. S. Marine Corps had first noted hearing loss four years previously. Preoperative audiograms revealed an average loss of 55 db. by air and of 26.6 db. by bone conduction for the speech frequencies in the poorer ear. Postoperative audiograms revealed an average loss of 28.3 db. by air in the same frequencies at the time of discharge from the service six weeks later.

Case 12. E. B., white female 26-year-old chief yeoman, U. S. Navy had first noted hearing loss at age 22. Preoperative audiograms revealed an average loss of 43.3 db. by air and of 15 db. by bone for the speech frea higher percentage of good results to the cases which are suitable for surgery This is especially true for those of us whose total number of cases will necessarily be small

SUMMARY

1 A brief account of the origin and development of endaural surgery of the temporal bone is given.

2 A report of a series of 25 cases of clinical otosclerosis treated by fenestration of the external semicircular canal is presented

3 The lessons to be learned from the early experiences of an average otologist taking up fenestration surgery are offered to those who are about to enter this field of operative otology, with the hope that it will help them in the selection of their cases for surgery

BIBLIOGRAPHY

1 LEMPERT J Radical Subcortical Mastoidectomy *Ann des Mal de L Oreille et de Larynx*, France, No 2, Feb, 1929

2 LEMPERT, J Complete Endaural Mastoidectomy *Monatsschr f Ohrenh u Laryngorhinol*, Germany, 64, Jahrg, 1930, 2 Heft

3 FOWLER, E P Hearing Before and After Radical Mastoidectomy *Arch Otolaryngol*, 26 387 394, Oct 1937

4 LEMPERT, J Endaural Antauricular Surgical Approach to Temporal Bone *Arch Otolaryngol*, 27 555 587, May, 1938

5 BROWN, J M The Radical Mastoid Operation *Amer Jour Surg* 42 142 150, Oct 1938

6 HOWARTH, W, and BATEMAN, G H The Endaural Approach to the Mastoid *Lancet*, 2 1168, Nov 19 1938

7 DAILY, L Refinements of Technique of Radical Operation and an Improved Plastic Flap *South Med Jour* 32 402-407 Apr 1939

8 WISHART, D E S Endaural Route THE LARYNGOSCOPE 49 96 965 Oct, 1939

9 JOHNSON, L F, and ZONDERMAN, B Experiences with Endaural Surgery, Preliminary Report *Arch Otolaryngol*, 33 1001 1007 June 1941

10 KETTEL, K Lempert Endaural Antauricular Approach to Temporal Bone Suggested *Modification of Technique in Tympanomastoidectomy* 55 Cases *Arch Otolaryngol*, 34 461-472 Sept, 1941

11 WILLIAMS, H L Antauricular Approach in Radical Mastoidectomy *Proc Staff Meeting Mayo Clinic*, 17 22 24, Jan 14 1942

12 WOODRUFF G H, and HENNER R Endaural Mastoidectomy Experience in Series of 76 Cases *Arch Otolaryngol*, 35 777 795, May 1942

13 Kend L. Modified Radical Mastoidectomy *Dis Eye Ear, Nose and Throat*, 2 214-218 July, 1942

14. Shambaugh, G E New Plastic Flap for Use in Endaural Radical Mastoidectomy *Ann Otol., Rhinol and Laryngol*, 51 117 121, 1942

15 Lathrop F D Endaural Atticomastoidectomy, Evaluation. The Laryngoscope, 53 589-601, Sept. 1943

16 McCurdy, G J Endaural Mastoidectomy, Five Years Experience. The Laryngoscope, 55 349-370 July 1945

17 Boyden, G L. Endaural Approach for Complete Mastoidectomy with Report of 43 Operations. *Ann Otol, Rhinol and Laryngol* 55 543 548 Sept. 1946

18 Kopetzky, S J Surgery of the Ear New York Thomas Nelson and Sons, 1947, pp 219-239

19 Lodge, W O Operative Treatment of Chronic Otitis Media *Jour Internat College Surgeons*, 10 197 207 Mar Apr 1947

20 Morrison, W W Endaural Surgery for Chronic Mastoiditis *Ann Otol., Rhinol and Laryngol.*, 56 317-327, June 1947

21 Whitaker, C F Juers, A. L. and Shambaugh G E, Jr. Modified Endaural Incision with Nerve Block Anesthesia *Arch Otolaryngol* 45 662-667 June 1947

for determining whether or not stapes fixation has occurred Apparently many degrees of stapes fixation can exist in otosclerosis

With these preliminary remarks as an introduction, we will offer pre- and postoperative findings in our first 25 cases of surgical otosclerosis

Case 1 Our first fenestration operation was performed on April 21 1946 on a 28 year old white male petty officer who had first noted hearing loss three or four years previously while in battle in the South Pacific Preoperative audiograms revealed an average loss of 38 3 db for the three speech frequencies by air and of 8 3 db by bone in the poorer ear On the table he heard a low whisper at 10 feet but the postoperative audiogram on the operated ear had dropped to an average loss of 18 3 db by air for the speech frequencies at the time of discharge from the service, June 1 1946

Case 2 D L 22 year old white male petty officer, U S Navy, complained of bilateral hearing loss and tinnitus, first noted in combat two years previously Preoperative audiograms revealed an average loss of 56 6 db by air and of 16 6 db by bone for the poorer ear On the table he heard a low whisper at 10 feet, but the postoperative audiograms had shown a drop to an average loss of 48 3 db for the speech frequencies four months later at the time of discharge from the service While this represents an improvement on paper, it must be classified as an unsuccessful result from a practical point of view

Case 3 M L, 25 year old, white female petty officer, U S Navy, first noted bilateral hearing loss and tinnitus two years previously She had never been exposed to a noisy environment Her preoperative audiograms revealed an average loss of 41 6 db by air and of 13 3 db by bone for the critical speech frequencies Speech reception was good for low whisper on the operating table, and her postoperative audiograms at discharge in August, 1946 showed an average loss of 15 db by air for the speech frequencies showing an average improvement of 26 db and allowing serviceable practical hearing This case was our first successful one and brought the percentage of successful results from zero up to 33

Case 4 A 23 year old, white male petty officer of the U S Coast Guard had first noted bilateral hearing loss and tinnitus four years previously during exposure to gunfire His preoperative audiograms showed an average loss of 55 db by air and 13 3 db by bone for the speech frequencies A low whisper was heard on the operating table and the first postoperative audiograms revealed an average loss of 31 6 db for the speech frequencies showing a gain of better than 20 db This gain slowly receded to the extent that an audiogram taken two months postoperatively showed an average loss of 38 3 db for the speech frequencies and at discharge three months postoperatively the hearing loss for speech had returned to the preoperative level

Case 5 H G, navy nurse aged 30 first noted bilateral hearing loss and unilateral tinnitus at age of 27 Preoperative audiograms revealed an average loss of 40 db by air and of 8 3 db by bone for the speech frequencies in the worse ear A low whisper was heard at 10 feet on the operating table Postoperative audiograms revealed an average loss of 33 3 db by air for the operated ear showing a gain of 16 7 db This gain had been maintained up to November, 1948

Case 6 Mrs E. G white 32 year-old wife of an enlisted man U S Navy first noted bilateral hearing loss three years previously Preoperative audiograms revealed an average loss of 46 6 db by air and of 20 db by bone for the speech frequencies in the poorer ear There was a 30 db loss by bone for the 2048 frequency and a 40 db loss by bone for the 4096 frequency On the operating table a low whisper was heard but postoperative audiograms at the time of discharge showed an average loss of 40 db by air for the speech frequencies The 2048 frequency had dropped to 55 db., and speech reception was poorer than before operation

Case 7 J C., 18 year-old white seaman, U S Navy first noted hearing loss at age 15 Preoperative audiogram revealed an average loss of 46 6 db by air and of 10 db by bone for the speech frequencies in the poorer ear Postoperative audiograms revealed an average loss of 25 db by air for the speech frequencies in the operated ear representing an average gain of 21 6 db at the time of return to duty two months postoperatively

Case 8 D L., white male 22 year old ships' cook U S Navy first noticed hearing loss at age 20 while exposed to gunfire Preoperative audiograms revealed an average loss of 56 6 db by air and of 16 6 db by bone for the speech frequencies Postoperative audiograms at first showed substantial gains but at the time of discharge from the service four months later the average loss had receded to 48 3 db by air indicating a poor result for all practical purposes

Case 9 W S white male 22 year old technical sergeant U S Marine Corps, had first noticed hearing loss and tinnitus at age 18 Preoperative audiograms revealed an average loss of 48 3 db by air and of 6 6 db by bone for the speech frequencies in the poorer ear Postoperative audiograms at the time of return to duty revealed an average loss by air of 18 1 db for the speech frequencies in the operated ear representing a gain of 30 db

Case 10 J G white male 18 year-old seaman U S Navy first noted hearing loss and tinnitus at age 15 Preoperative audiograms revealed an average loss of 35 db by air and of 5 db by bone for the speech frequencies in the right ear with similar loss for air in the left but with poorer bone conduction in the left ear This patient revealed a promontory blush on otoscopy and his speech reception was poorer than his audiometric loss would indicate At operation however a low whisper was understood after the fenestra had been created and postoperative audiograms were satisfactory revealing an average loss of 21 6 db by air for the speech frequencies at the time of return to duty two months later

Case 11 E Z white male 31 year-old private U S Marine Corps had first noted hearing loss four years previously Preoperative audiograms revealed an average loss of 55 db by air and of 26 6 db by bone conduction for the speech frequencies in the poorer ear Postoperative audiograms revealed an average loss of 28 3 db by air in the same frequencies at the time of discharge from the service six weeks later

Case 12 E B white female 26 year-old chief yeoman U S Navy had first noted hearing loss at age 22 Preoperative audiograms revealed an average loss of 43 3 db by air and of 15 db by bone for the speech frequencies in the poorer ear At operation a low whisper was understood Audiograms at the time of discharge from the service three months later showed an average loss of 25 d by air for the speech frequencies

Case 13 F H, white female 27 year old wife of naval officer had first noted hearing loss two years before admission Preoperative audiograms revealed an average loss of 56 6 db by air and of 21 6 db by bone for the speech frequencies in the poorer ear Early postoperative audiograms revealed average losses of 55 db by air for the speech range but a month later there was an average loss of 23 3 db by air for the speech frequencies, indicating an average gain of 33 3 db for the speech range

Case 14 J I white female 42 year old wife of naval officer, had been hard of hearing for seven years when first seen Preoperative audiograms revealed an average loss of 46 6 db by air and of 11 6 db by bone for the speech frequencies in the poorer ear Postoperative audiograms revealed an average loss of 11 6 db by air for the speech frequencies at the time of discharge six weeks later A transient facial paresis responded rapidly to treatment with galvanic stimulation and massage so that no residuals were visible after three months

Case 15 R A, white male 50 year old veteran of World War I had noted hearing loss of mild degree in both ears for several years but the loss had become much more accentuated after an automobile accident 18 months prior to admission had resulted in serious skeletal injuries leading to a wheel chair existence Preoperative audiograms revealed an average loss of 53 3 db by air and of 26 6 db by bone for the speech frequencies however the higher tones of the scale were heard very poorly, and no frequency above 4096 d v was heard Speech reception on the other hand, was good with adequate amplification After much thought and several consultations with other otologists, surgery was recommended in the hope of delaying further progress of the disease and to try to improve hearing to a practical level A low whisper was heard at two feet on the operating table immediately after the fenestra had been made Postoperative audiograms revealed an average loss of 36 6 db by air for the speech frequencies but the subjective improvement was much more marked than audiometry would indicate and was sufficiently rehabilitating to the patient to cause him to seek operation on the unoperated ear so that it could be brought up to the level of the operated ear Practical serviceable hearing was not obtained however, and this case must be recorded as a failure

Case 16 M J white female 24 year old wife of chief petty officer U S Navy first noticed hearing loss in both ears at age of 19 Preoperative audiograms revealed an average loss of 48 3 db by air and of 13 3 db by bone for the speech frequencies in the poorer ear Postoperative audiograms revealed an average loss of 10 db by air for the speech frequencies at discharge three weeks later, however 18 months later audiograms revealed an average loss of 33 3 db by air for the speech frequencies in the operated ear The 2048 frequency at this time showed a loss of only 25 db and ordinary conversation was well understood This case represented a delayed response to surgery that could possibly be explained on a psychogenic basis At the time of her operation she was in poor spirits because of marital difficulties A year after surgery however she had divorced her husband and six months later when her hearing was retested she had acquired a new younger mate and her outlook on life was much more optimistic Whether or not this had any effect on the audiogram is a matter of opinion

Case 17 M H white male 30 year old veteran of World War II had first noted hearing loss and tinnitus at age 25 Preoperative audiograms revealed an average loss of 46 6 db by air and of 20 db by bone for the speech frequencies Although good reception of whisper was obtained at operation subsequent audiograms were never encouraging and the average loss at the time of discharge from the hospital was 41 6 db by air for the speech range A revision on this ear was performed six months later and the fenestra was found to be completely occluded by fibrous tissues A new fenestra was created posterior to the occluded one on the external semicircular canal, and the flap was replaced but no improvement was obtained postoperatively

Case 18 L M white male, 27 year-old dental officer U S Navy had first noted hearing loss in both ears seven years prior to surgery The left ear had been successfully fenestrated in 1943 and had maintained a satisfactory hearing gain The right ear revealed an average loss of 43 3 db by air and of 8 3 db by bone for the speech frequencies At operation a low whisper was well understood Postoperative audiograms revealed an average loss of 21 6 db by air for the speech frequencies in the right ear at the time of discharge three weeks postoperatively

Case 19 L B white male 25-year-old veteran of World War II had first noticed hearing loss and tinnitus in both ears about four years prior to admission Preoperative audiograms revealed an average loss of 46 6 db by air and of 15 db by bone for the speech frequencies Postoperative audiograms revealed an average loss of 21 6 db by air for the same frequencies The apparent rehabilitation in this patient was very gratifying

Case 20 E. O, white female 32 year-old army nurse first noted hearing loss four years before admission. Preoperative audiograms revealed an average loss of 45 db by air and of 13 3 db by bone for the speech frequencies in the poorer ear but speech reception was much worse than audiometry indicated At operation low whisper was well understood and postoperative audiograms revealed an average loss of 11 6 db for the speech range at the time of discharge

Case 21 R H white male 23 year old veteran of World War II first noticed bilateral hearing loss at age 20 Preoperative audiograms revealed an average loss of 51 6 db by air and of 15 db by bone for the speech frequencies Postoperative audiograms revealed an average loss of 11 6 db by air for the speech range in the operated ear at the time of discharge

Case 22 A. E white female 32 year-old dependent wife of naval officer first noticed hearing loss at about age 27 Preoperative audiograms revealed an average loss of 50 db by air and of 13 3 db by bone for the speech frequencies A low whisper was understood on the operating table and postoperative audiograms at the time of discharge revealed an average loss of 16 6 db by air for the speech frequencies

Case 23 N A white male 38 year-old veteran of World War II first noted hearing loss in both ears about 10 years prior to admission Preoperative audiograms revealed an average loss of 5 db by air and of 28 3 db by bone for the speech frequencies in the poorer ear Postoperative audiograms revealed an average loss of 20 db by air for the speech frequencies a higher percentage of good results to the cases which are suitable for surgery This is especially true for those of us whose total number of cases will necessarily be small

SUMMARY

1 A brief account of the origin and development of endaural surgery of the temporal bone is given

2 A report of a series of 25 cases of clinical otosclerosis treated by fenestration of the external semicircular canal is presented

3 The lessons to be learned from the early experiences of an average otologist taking up fenestration surgery are offered to those who are about to enter this field of operative otology, with the hope that it will help them in the selection of their cases for surgery

BIBLIOGRAPHY

1 LEMPERT J Radical Subcortical Mastoidectomy *Ann des Mal de L Oreille et de Larynx*, France No 2 Feb, 1929

2 LEMPERT, J Complete Endaural Mastoidectomy *Monatsschr f Ohrenh u Laryngorhinol*, Germany, 64, Jahrg, 1930, 2 Heft

3 FOWLER, E P Hearing Before and After Radical Mastoidectomy *Arch Otolaryngol*, 26 387 394, Oct, 1937

4 LEMPERT J Endaural Antauricular Surgical Approach to Temporal Bone *Arch Otolaryngol*, 27 555 587, May 1938

5 BROWN, J M The Radical Mastoid Operation *Amer Jour Surg* 42 142 150, Oct, 1938

6 HOWARTH, W, and BATEMAN, G H The Endaural Approach to the Mastoid *Lancet*, 2 1168, Nov 19 1938

7 DAILY, L Refinements of Technique of Radical Operation and an Improved Plastic Flap *South Med Jour*, 32 402 407, Apr 1939

8 WISHART, D E S Endaural Route THE LARYNGOSCOPE, 49 965 Oct 1939

9 JOHNSON, L F and ZONDERMAN, B Experiences with Endaural Surgery, Preliminary Report *Arch Otolaryngol* 33 1004 1007 June 1941

10 KETTEL, K Lempert Endaural Antauricular Approach to Temporal Bone, Suggested Modification of Technique in Tympanomastoidectomy 55 Cases *Arch Otolaryngol*, 34 461 472 Sept 1941

11 WILLIAMS H L Antauricular Approach in Radical Mastoidecto *Proc Staff Meeting Mayo Clinic*, 17 22 24, Jan 14 1942

12 WOODRUFF G H and HENNER R Endaural Mastoidectomy Experience in Series of 76 Cases *Arch Otolaryngol*, 35 777 795 May 1942

13 KEND, L. Modified Radical Mastoidectomy *Dis Eye, Ear, Nose and Throat*, 2 214 218 July, 1942

14 SHAMBAUGH, G E New Plastic Flap for Use in Endaural Radical Mastoidectomy *Ann Otol, Rhinol and Laryngol*, 51 117 121, 1942

15 LATHROP, F D Endaural Atticomastoidectomy, Evaluation. THE LARYNGOSCOPE, 53 589-601, Sept 1943

16 McCURDY, G J Endaural Mastoidectomy, Five Years' Experience THE LARYNGOSCOPE, 55 349 370, July, 1945

17 BOYDEN, G L. Endaural Approach for Complete Mastoidectomy with Report of 43 Operations *Ann Otol, Rhinol and Laryngol* 55 543 548 Sept. 1946

18 KOPETZKY, S J Surgery of the Ear New York Thomas Nelson and Sons, 1947 pp 219 239

19 LODGE, W O Operative Treatment of Chronic Otitis Media *Jour Internat College Surgeons*, 10 197 207 Mar Apr 1947

20 MORRISON, W W Endaural Surgery for Chronic Mastoiditis *Ann Otol, Rhinol and Laryngol*, 56 317-327, June, 1947

21 WHITAKER, C F JUERS, A. L, and SHAMBAUGH, G E, JR. Modified Endaural Incision with Nerve Block Anesthesia *Arch Otolaryngol*, 45 662 667, June 1947

CHRONIC SECRETORY OTITIS MEDIA.*

RAY JORDAN, M.D.,
Pittsburgh, Pa.

The purpose of this paper is to discuss the etiology, signs, symptoms, pathology and treatment of chronic secretory otitis media. This discussion is based on 123 private patients seen in the past two years. A clarification of terminology will be made. The use of radium for this condition is analyzed and a report of irradiation of the nasopharynx is given.

Secretory otitis media is now an accepted term for a definite clinical entity. Terms frequently seen in recent literature are otitis media with effusion and catarrhal otitis media. Earlier the condition was designated as seromucus middle ear catarrh, exudative middle ear catarrh, serous otitis media, hydrotympanum, secretory middle ear catarrh, secretory transudative noninflammatory middle ear disease and secretory exudative otitis media. The condition is not new, having been described by Politzer[10] in 1869. Increased public interest in hearing problems and routine hearing examinations in the public schools probably account for the apparent increase in the number of these cases.

The paper will not deal with aerotitis or with acute or subacute secretory otitis of short duration, frequently seen associated with an acute upper respiratory infection. In both conditions the etiology is apparent and response to inflations and paracentesis, if indicated, brings rapid and permanent relief. Mucus otitis media, in which the Eustachian tube is apparently patent and the middle ear exudate gelatinous in consistency, is not included in this discussion.

---

*Presented as Candidate's Thesis to American Laryngological, Rhinological and Otological Society, Inc., 1949.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication April 25, 1949.

The cases used in this paper were all seen as private patients and were recorded as the diagnosis was made The age groups were as follows 75 were in the one to 10-year group, 22 were between 11 and 20 years old and 26 were over 21 years of age

The pathogenesis is apparently a closure of the Eustachian tube, preventing proper ventilation of the middle ear cavity The lack of ventilation results in absorption of the remaining air in the middle ear cavity, creating a partial vacuum This vacuum is replaced, or partially replaced, by a transudation or exudation Hantman[4] states it may be both a transudation and exudation, and Lowry[9] offers evidence of the transudative nature of the fluid All agree, including this writer, that if the Eustachian tube is made patent and remains so, and the fluid is evacuated either by nature or mechanically, the middle ear remains clear of fluid The cause of the closure of the Eustachian tube is then the important factor in the condition

The primary etiologic factors of this group of cases were found to be as follows 91 cases, or 73 98 per cent, were due to allergy, nasopharyngeal adhesions and chronic infection were found in 28 cases, or 22 76 per cent, and four cases, or 3.25 per cent, were attributed to diseased adenoids

The diagnosis of allergy was made by nasal smears, skin testing and response to allergic therapy A trial period of antihistaminics was very helpful in establishing the diagnosis It was possible to get positive nasal smears in the majority of this group by repeated observations The proof of allergy as a predominant etiologic factor was demonstrated in all but three of these 91 cases by cessation of symptoms after proper allergic management Further proof was frequently seen in the allergic patient who prematurely discontinued treatment, only to have fluid reappear in the middle ears and to be relieved again after resumption of allergic care The three cases mentioned above are still under treatment and have not at this date been controlled Lewis[5] reports six cases of secretory otitis media, all of which gave allergic histories Proetz[11] reports several cases of secretory otitis media following allergy He describes a case of a 15-month-old child who had secretory otitis media with each attack of asthma

Nasopharyngeal adhesions along the lateral pharyngeal bands causing distortion of the pharyngeal orifice of the Eustachian tube with decreased patency was the next most common cause Infected lymphoid tissue of the nasopharynx was the third etiologic factor found Since, as Robison[13] states, "The pharyngeal orifice of the Eustachian tube shares in the inflammatory reaction of the nasopharyngeal tissue," this can cause closure of the tube It was not always possible to differentiate between chronic adhesions and chronic infection, since in many of the remaining cases it was coincidental, therefore, the 28 remaining cases were considered as one group

The rôle that diseased or hypertrophied tonsils and adenoids plays in this condition seems minor Of the 91 cases in this series which had tonsils and adenoids removed, 18 were done after being seen in the office Ten of these cases were allergic and had recurrence of the secretory otitis media, which did not subside until after the allergy was controlled Four of the remaining eight cases required further nasopharyngeal treatment, and four remained clear after tonsillectomy and adenoidectomy It is interesting to note that of 804 cases of secretory otitis media reported by Hoople[7] and Blaisdale, only 50 cases were attributed to diseased tonsils

A consistent finding in this group of cases was the marked hypertrophy of the tonsils and adenoids in the allergic child In the allergic patient the recurrent adenoids were always much larger than in the nonallergic patient Two cases had chronic suppurative maxillary sinusitis, but no improvement was obtained after clearing the infected sinuses, and improvement occurred only after control of the existing allergy The other etiologic factors listed in the report of Hoople and Blaisdale were not encountered

The etiologic factor proposed by Robison, of pressure on, or displacement of, the lumen of the tube by a nasopharyngeal lymph node in the region the tube traverses could not be determined

The symptomatology found in this group of cases coincided with the literature The unsolicited chief complaints were as follows 77 cases were brought to the office because of suspected hearing loss The hearing loss was usually mild in children and more severe in adults, as illustrated by Charts 1 and 2 Frequent attacks of earache was the history obtained

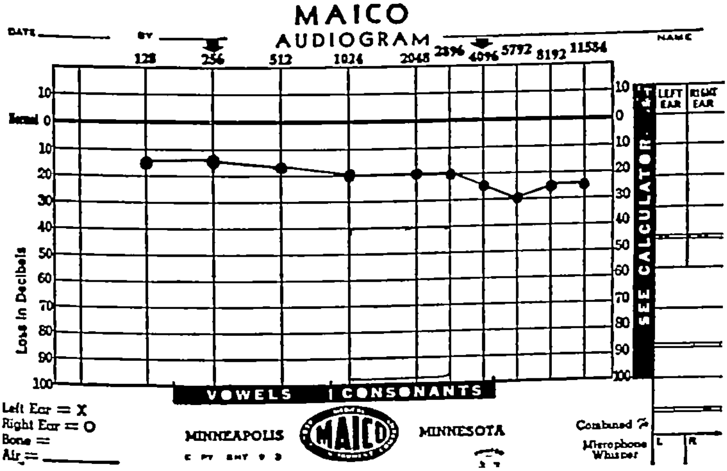


Chart 1 Average hearing loss for age group five to 15 years

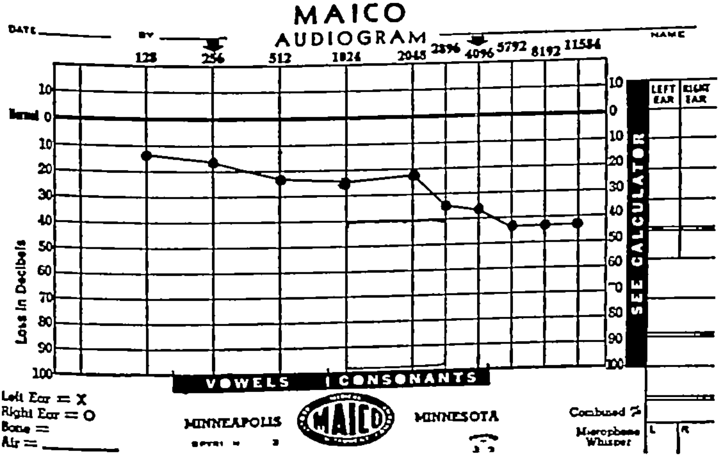


Chart 2 Average hearing loss for age group over 15 years

in 16 cases Fourteen cases complained of frequent colds Aural stuffiness was noted in 10 cases A varying type of tinnitus, commonly a low-pitched buzzing, was the chief complaint in six cases All the above symptoms occurred in many of these cases, although stuffiness and tinnitus were more common in the group over 21 Less common but definitely diagnostic symptoms were the complaints of splashing in the ear on motion and fluctuation of hearing with change of position of the head The duration of the symptoms in this group was from one week to 30 years A past history of aural discharge was found in 42 cases, of these, 30 were allergic

The most constant physical sign in this group of cases was a yellowish red cast of the drum seen in a slightly retracted position No inward motion could be produced by a Siegel otoscope, but occasionally a slight outward or lateral motion of the drum occurs with suction The drums were also seen to be in the normal position and rarely slightly bulging The color of the drumhead was sometimes a bluish red, especially in those cases in which the drum was slightly bulging A fluid level or air bubbles were rarely seen initially, but commonly seen in the middle ear cavity after inflation A positive means of diagnosis is a simple paracentesis without anesthesia, followed by inflation and spot suction The procedure results in forcing straw-colored fluid through the paracentesis and clearing the middle ear The tympanum then appears normal in color and position In those cases in which the drumhead was relatively transparent, the hyperemia and edema of the mucosa of the inner wall of the middle ear cavity was quite apparent In many cases following paracentesis, air could be seen entering the middle ear cavity, indicating incomplete relief of the vacuum created in the middle ear Another observation in these cases following paracentesis was a slow filling of the middle ear after initial evacuation by tilting the head slightly forward No actual measurement was made of the fluid recovered from the middle ear cavity, but an estimation would place the amount from 0 1 to 2 cc Direct smears of the fluid recovered revealed no bacteria, there were some scattered polymorphonuclear leucocytes and occasional eosinophiles

Early in the study of this group the treatment was somewhat standardized Local treatment to the nose and throat was prescribed as indicated, Eustachian tubal inflations following simple paracentesis of the tympanic membrane were done in older children and adults, the younger children were Politzerized, if the tonsils and adenoids were present, these were removed Eighteen tonsillectomies and adenoidectomies were done after the diagnosis of secretory otitis media was made All but four had recurrence of symptoms, the time varying from no change in the aural findings to one year's relief If the adenoids and tonsils had been removed prior to being seen in the office, secondary adenoidectomy and/or radiation was performed Careful secondary adenoidectomies were done, with emphasis upon manual removal of adhesions along the lateral pharyngeal bands Radiation therapy was done after the technique described by Crowe A standard monel metal radium applicator made by the Radium Chemical Co for this purpose was used The average number of radiations was two, the largest number, eight Sixty-six cases were treated in the following manner 11 cases had secondary adenoidectomies, 33 cases had secondary adenoidectomies and radiation therapy, and 22 cases were treated with radium alone Of these 66 cases, 35 had recurrence of symptoms, ranging from two weeks to 14 months The largest number of recurrences occurred two months after the last treatment This relatively high percentage of recurrences stimulated further search for the cause With a more thorough history, repeated nasal smears and trial periods on antihistaminic medication, 34 of these cases were found to be allergic None of the 34 cases which recurred received less than three radiations, and one case eight radiations Another case received five X-ray treatments and three radiations

Because of the indefinite results obtained in radiated cases, some experimental work was tried to determine the effect of radium on lymphoid tissue Twenty-nine children between the ages of five and 13 scheduled for routine tonsillectomies and adenoidectomies were used The adenoids of these patients were radiated with the standard radium applicator and then removed and sectioned To prevent errors due to a faulty applicator, the technique was uniform and carried out in the following manner Three standard monel metal radium applicators were used The applicator was inserted along the floor of the nose until it came in contact with the posterior wall of the nasopharynx No attempt was made to push the applicator laterally The same procedure was repeated through the other nasal cavity so that the central mass of adenoid tissue received radiation from both sides After varying time intervals the adenoids were removed for sectioning An adenatome to fit the nasopharynx was used and the first mass of adenoid tissue removed was immediately placed in Zenker's solution and sent to the laboratory for sectioning

The first group of 15 were irradiated for eight and one-half minutes The number of irradiations varied from one to three and the adenoids were removed at various intervals from one to six weeks after the final irradiation

The sections were read by Dr Mathew Block,[1] Department of Hematology, University of Chicago, and Dr E E Heller,[2] Professor of Pathology, University of Pittsburgh The following report is a consolidation of their opinions

Slide No 2283 from tissue removed three days after one irradiation seemed to show some changes but could not be said definitely to be pure irradiation changes There seemed to be fewer mitoses than in the controls selected at random The secondary follicles of the germinal centers contained fewer lymphocytes, making them appear to contain more reticulum cells The secondary follicles appear also a little smaller than in the controls Slide No 2281 from tissue removed three days after one radiation did not contain any nuclear debris such as is usually visible at an early stage following irradiation, presumably therefore, it had been cleared up by phagocytosis The opinion was, therefore that there were fewer mitoses in the secondary nodules These nodules seemed to be a little smaller than in the controls The secondary nodules have fewer lymphocytes and consist mainly of closely packed reticulum cells There is less nuclear debris, possibly the results of irradiation

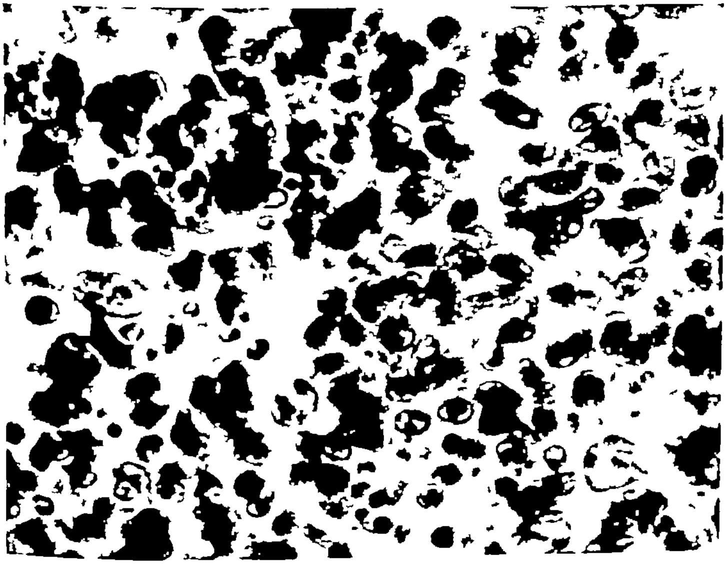
Slide No 1645 one week after one irradiation and Slide No 2068 three weeks after one irradiation again show mitoses Regeneration seems to be fairly complete

Slide No 2822 from tissue removed five weeks after two irradiations, Slide No 2821 removed two weeks after three irradiations and Slide No 3111 removed six weeks after three irradiations cannot be said to show anything definitely abnormal It is possible that grossly the adenoids might be smaller but microscopically one would not expect to [illegible] a change so long after treatment

No microphotographs were made of these sections because of the indefinite findings

After Crowe[3] advocated the change of radiation time from eight and one-half minutes to 12 minutes, the experiment was repeated, using 14 subjects Similar technique, number of radiations and time intervals were used with the exception that at the suggestion of Dr Block, sections were also taken 18 hours after one radiation The sections were again read as above, and the following is a consolidated report of the findings

The specimens removed 18 hours after beta radiation show degeneration. Large numbers of degenerated lymphocytes are seen in the nodules as illustrated by photomicrograph S 48-410 No mitoses or other regenerative processes are seen Numerous large phagocytes crammed with nuclear debris are seen in the primary follicles as shown in Photomicrograph S-48 650 In one slide (see Photomicrograph S-48 651) the epithelium shows a marked change The epithelial cells are distended and vacuolated architecture is disturbed and adjacent lymphocytes are degenerated This may represent a point of contact with the radium capsule since epithelial tissue in general is very resistant to radiation



Photomicrograph S-48-410 Degenerated lymphocytes are seen in the nodules removed and sectioned To prevent errors due to a faulty applicator, the technique was uniform and carried out in the following manner Three standard monel metal radium applicators were used The applicator was inserted along the floor of the nose until it came in contact with the posterior wall of the nasopharynx No attempt was made to push the applicator laterally The same procedure was repeated through the other nasal cavity so that the central mass of adenoid tissue received radiation from both sides After varying time intervals the adenoids were removed for sectioning An adenatome to fit the nasopharynx was used and the first mass of adenoid tissue removed was immediately placed in Zenker's solution and sent to the laboratory for sectioning

The first group of 15 were irradiated for eight and one-half minutes The number of irradiations varied from one to three and the adenoids were removed at various intervals from one to six weeks after the final irradiation

The sections were read by Dr Mathew Block,[1] Department of Hematology, University of Chicago, and Dr E E Heller, Professor of Pathology, University of Pittsburgh The following report is a consolidation of their opinions

Slide No 2283 from tissue removed three days after one irradiation seemed to show some changes but could not be said definitely to be pure irradiation changes There seemed to be fewer mitoses than in the controls selected at random The secondary follicles of the germinal centers contained fewer lymphocytes, making them appear to contain more reticulum cells The secondary follicles appear also a little smaller than in the controls Slide No 2281 from tissue removed three days after one radiation did not contain any nuclear debris such as is usually visible at an early stage following irradiation, presumably therefore it had been cleared up by phagocytosis The opinion was therefore that there were fewer mitoses in the secondary nodules These nodules seemed to be a little smaller than in the controls The secondary nodules have fewer lymphocytes and consist mainly of closely packed reticulum cells There is less nuclear debris, possibly the results of irradiation

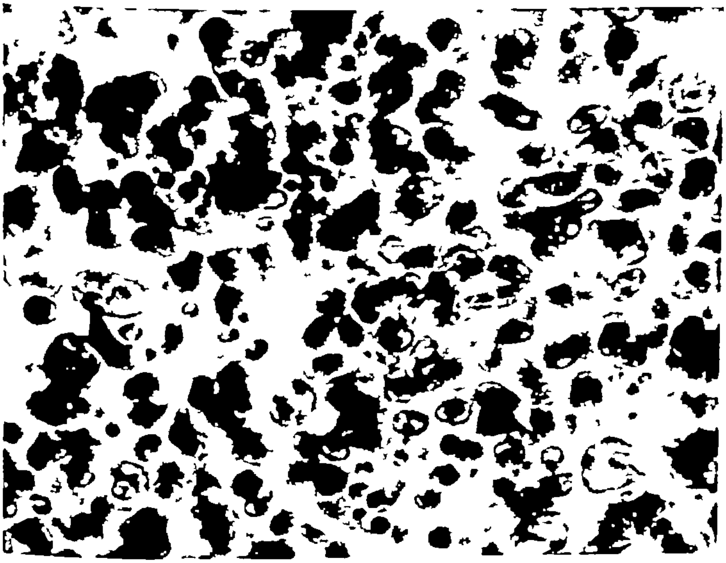
Slide No 1645, one week after one irradiation and Slide No 2965 thre weeks after one irradiation again show mitoses Regeneration seems to be fairly complete

Slide No 2822 from tissue removed five weeks after two irradiations and Slide No 2821 removed two weeks after three irradiations and Slide No 3111 removed six weeks after three irradiations cannot be said to show anything definitely abnormal It is possible that grossly the adenoids might be smaller but microscopically one would not expect to a change so long after treatment

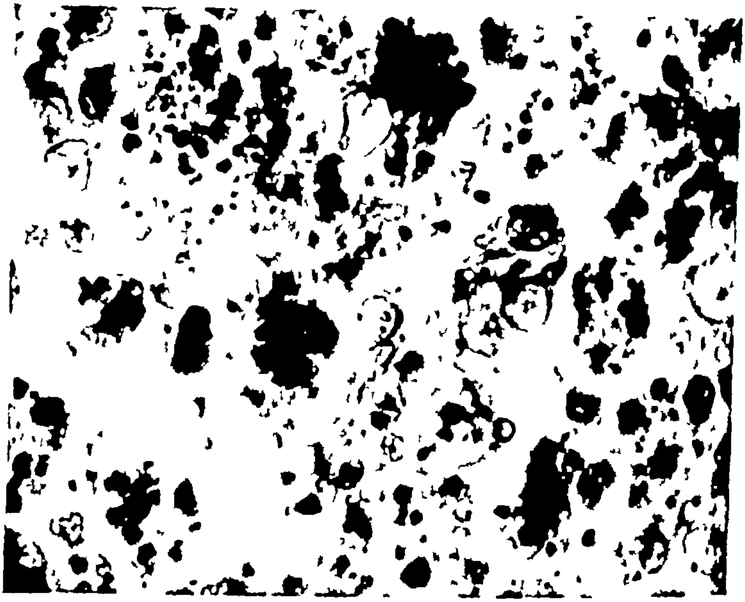
No microphotographs were made of these sections because of the indefinite findings

After Crowe[3] advocated the change of radiation time from eight and one-half minutes to 12 minutes, the experiment was repeated, using 14 subjects Similar technique, number of radiations and time intervals were used with the exception that at the suggestion of Dr Block, sections were also taken 18 hours after one radiation The sections were again read as above, and the following is a consolidated report of the findings

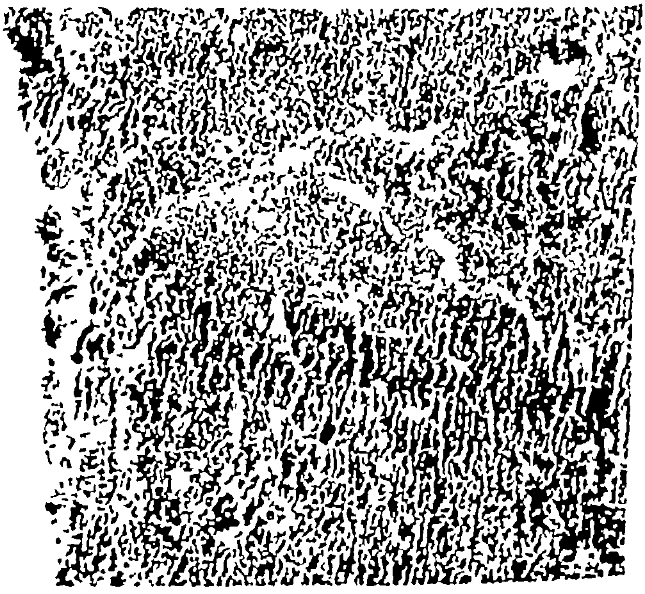
The specimens removed 18 hours after beta radiation show degeneration. Large numbers of degenerated lymphocytes are seen in the nodules as illustrated by photomicrograph S 48-410 No mitoses or other regenerative processes are seen Numerous large phagocytes crammed with nuclear debris are seen in the primary follicles as shown in Photomicrograph S-48 650 In one slide (see Photomicrograph S-48 651) the epithelium shows a marked change The epithelial cells are distended and vacuolated architecture is disturbed and adjacent lymphocytes are degenerated This may represent a point of contact with the radium capsule since epithelial tissue in general is very resistant to radiation



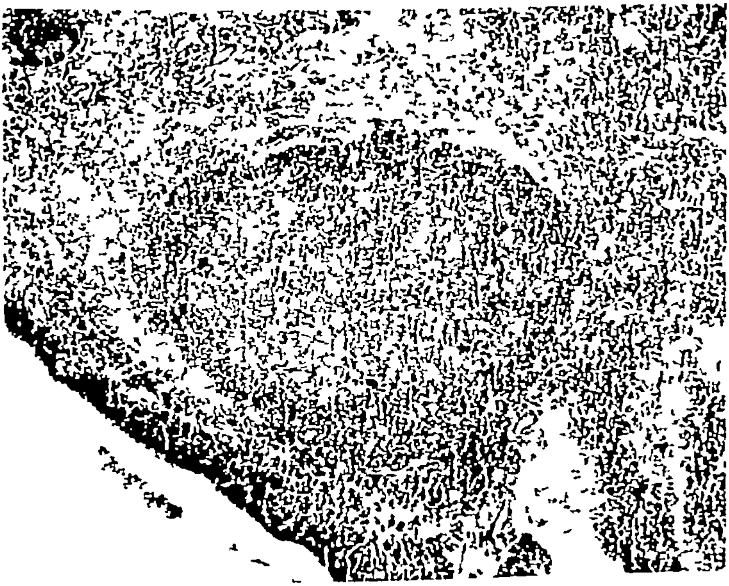
Photomicrograph S-48-410 Degenerated lymphocytes are seen in the nodules.



Photomicrograph S-18 650 Large phagocytes crammed with nuclear debris are seen in the primary follicles



Photomicrograph S 18 651 The epithelium shows a marked cla [illegible]
Probably represents a point of contact with the radium capsule



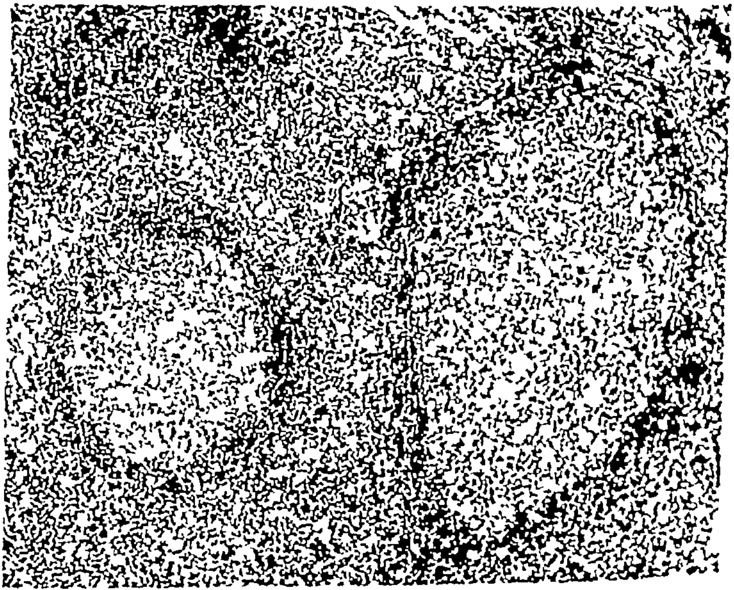
Photomicrograph S-47-4017 Shows monomorphous appearance of the nodules.

Photomicrograph S-47-4164 The increase in the venous sinusoids and capillaries is shown.

In the slides of tissue removed 14 days after one irradiation there is marked regeneration of the lymphoid nodules Mitotic figures are fairly numerous in most sections of this group Another section made of tissue irradiated once and removed in 14 days shows the monomorphous appearance of the nodules This seems consistent when one remembers that medium lymphocytes in this phase of regeneration predominate the picture Photomicrograph S 47 4017 illustrates this period of regeneration

In the sections of tissue removed 14 days after two radiations, a mild increase in the number of venous sinusoids and capillaries are noted, as shown in Photomicrograph S 47 4164

Sections of tissue removed six weeks after three irradiations show active, healthy lymphoid nodules Many mitotic figures are still seen however Photomicrograph S 48 58 is taken of one of these sections of tissue



Photomicrograph S-48-58 Section of tissue removed six weeks after three irradiations shows active healthy lymphoid nodules

Further comments from Dr Block's report are as follows "Reticulocytes are not affected by the usual therapeutic doses of irradiation Their survival deflates complete destruction of lymphoid tissue It seems quite certain that the medium large lymphocytes develop from these undamaged reticulocytes They in turn develop into small lymphocytes These small lymphocytes are pushed to the periphery of the lymphoid nodule and end up in the peripheral blood stream Unless they go into the blood faster than they are produced, they form a ring around the lymphoid nodule It seems apparent from these slides that *1* radiation reaction in the lymphoid tissue is marked, *2* a stage of atrophy is present, *3* regeneration of the lymphoid tissue is so complete as to appear histologically normal in six to eight weeks It is not possible to say from these microscopic slides whether any permanent decrease in mass of the lymphoid tissue has taken place Judging from the histologic picture, one would expect very little permanent change"

The literature contains similar observations as made above Heineki,[5] in 1902-1905, described the extreme sensitivity of all lymphoid tissue to irradiation In 1925, Quick[12] and Cutler published a study of the effect of radiation on lymph nodes They noted that normal nodes subjected to irradiation enlarged instead of becoming smaller

The above histologic studies of irradiated adenoids coincide with the clinical findings of initial beneficial effect followed by recurrences Two-thirds of the cases treated by irradiation were treated for eight and one-half minutes, and the remainder for 12 minutes No clinical difference was noted in the end-result following irradiations of eight and one-half or of 12 minutes Of the 55 cases which received irradiation therapy, 28 recurred All of these cases subsequently proved to be allergic Of the 11 cases which had secondary adenoidectomies, seven cases recurred and of these six were allergic Thus in the presence of a chronic stimulation, such as uncontrolled nasal allergy, lymphoid hyperplasia continues, although momentarily delayed by irradiation, surgery or both

Fifty-seven cases of known allergy were treated primarily by allergic management. All but three of these cases are completely free of fluid in the middle ears These three cases have not as yet been allergically controlled Recurrence in this group occurred also, but always followed cessation of allergic treatment or an acute allergic exacerbation All cases returned to normal when allergic management was again instituted

Paracentesis and inflations seem to hasten the recovery of those patients but cannot be considered a curative measure without removing the etiology

CONCLUSIONS

Secretory otitis media is a common clinical entity

The most frequent etiologic factor is nasal allergy

Other etiologic factors are nasopharyngeal adhesions, chronic infected lymphoid tissue in the nasopharynx and hypertrophied adenoids

The signs and symptoms are consistent and the hearing loss not great

The most consistent favorable results in the allergic group occurred with removal of the offending allergen or desensitization

Removal of nasopharyngeal adhesions and infected lymphoid tissue along with inflations and paracentesis have given good results in the nonallergic cases

The value of irradiations in this condition for any prolonged effect remains doubtful

REFERENCES

1 Block, Matthew Department of Hematology, University of Chicago—personal communication

2 Crowe S J, and Burnam C F Recognition Treatment and Prevention of Hearing Impairment in Children *Ann Otol Rhinol and Laryngol*, 50 15 31 1941

3 Crowe, S J *Yearbook of Eyes, Ears, Nose and Throat* p 225 1937

4 Hantman, Irvin Secretory Otitis Media *Arch Otolaryngol* Vol 38 1943

5 Heineke M Ueber die Einwirkung der Rontgenstrahlen auf Tiere *Munchen med Wchnschr* 50 2090 2092, Dec, 1903

Experimentelle Untersuchungen uber die Einwirkung der Rontgenstrahlen auf innere Organe *Mitt a d Grenzgeb d Med u Chir* 14 21 94 1905

6 Heller E E Professor of Pathology, University of Pittsburgh—personal communication

7 Hoople, Gordon D and Blaisdell J H The Problem of Acute Catarrhal Otitis Media *Ann Otol Rhinol and Laryngol* 52 359 1943

8 LEWIS, E R Otitis Media and Allergy *Ann Otol Rhinol and Laryngol.*, 38 185 1929

9 LOWRY K. Concerning the Pathology of Secretory Otitis Media *Monatsschr f Ohrenh*, 72 40 1938

10 POLITZER, ADAM Disease of the Ear 1926

11. PROETZ, A. W Allergy in the Middle and the Internal Ear *Ann Otol., Rhinol and Laryngol* 40 67 1931

12 QUICK DOUGLAS, and CUTLER MAX Radiation Reaction of Metastatic Squamous Cell Carcinoma in Cervical Lymph Nodes *Amer Jour Roent* 14 529-539 Dec 1925

13 ROBISON, J M Subacute Catarrhal Otitis Media and Mastoiditis with Effusion. *South Med Jour* 35 815 Sept, 1942

LINGUAL TONSILS (A NEW EVALUATION)*†

LOUIS K ELFMAN, M D,
Philadelphia, Pa

The lingual tonsil has been a much neglected subject I 25 years of laryngology, I have yet to see a laryngologis remove an honest-to-goodness pair of lingual tonsils at any o the hospitals which I have attended, including two teaching institutions

It is a subject which has been slighted by laryngologists and glossed over by the authors of books on otolaryngology, and by investigators of the tonsils, Waldeyer's ring and the pharynx

About six months ago I read an extensive article, in one of the laryngeal journals, describing all the diseases of the throat In the concluding paragraph, there were two sentences giving vague reference to the lingual tonsils Apparently the linguals were not important to the investigator

For a number of years I have put much thought and work on this subject, and I hope to stimulate some interest which may lead to a better understanding of the linguals

In teaching laryngology to postgraduate students, I often show specimens, preserved in formalin, which are so large that they elicit expressions of amazement

My own interest in the subject started some years ago, in a laryngeal clinic An adult male patient, with a severe arthritis of the cervical spine, was sent to the clinic for an

---

*Read before Reading Eye Ear Nose and Throat Society Sept 15 194

†Read before Section of Otolaryngology Philadelphia College of Phy cians Nov 17 1948

Editor's Note This ms. received in Laryngoscope Office and accepted f publication March 5 1949

ear, nose and throat examination. He had tremendously large lingual tonsils which almost filled the hypopharynx, and gave the impression of a tongue tumor. A biopsy showed chronic inflammation of lymphoid tissue. Having resolved that the mass was nonmalignant, the question of removal came up. The various men asked to remove it balked at the idea, as they were afraid of lingual hemorrhage. Never having removed linguals myself, I decided to attempt it, and to my surprise I was able to do a clean operation, without much difficulty, by means of a pair of long, curved scissors and a tonsil snare. The patient had quite a sore throat for about 10 days but made an uneventful recovery. His symptoms of arthritis improved. From this one case, my interest in the subject broadened, and I have followed it up with an extensive series of cases, from which I can make definite deductions.

ANATOMY, HISTOLOGY AND HISTOPATHOLOGY OF THE LINGUAL TONSILS

The lingual tonsil consists of a variable number of small lymphoid nodules at the base of the tongue, in front of the epiglottis and behind the line of circumvallate papillae or taste buds. The plica triangularis, which is frequently removed at the end of a tonsillectomy, is not the lingual tonsil, as some laryngologists call it. There may be a small mass of lymphoid tissue of variable size where the plica attaches to the tongue, but anatomically this it not a lingual tonsil.

The lymphoid nodules at the base of the tongue and in front of the epiglottis are usually small and inconspicuous. These nodules may hypertrophy and also increase in number, in which case a prominent mass begins to form on each side of the base of the tongue, forming a true pair of lingual tonsils. The lingual tonsils rest on a basement membrane analogous to the capsule of the faucial tonsils. Beneath this basement membrane is the musculature of the tongue.

When sectioned laterally, the nodules appear as discrete hemispheres with narrow intervals between them. Each nodule has two or three crypts, extending from the epithelial surface nearly to the capsule, which are dovetailed by several fibrous trabeculae from the capsule The crypts are not tortuous The epithelium, like that of the faucial tonsil, is stratified and squamous, and possesses mucous glands The lymphoid tissue differs in no way from that of the faucial tonsil

Between the two linguals is a fibrous band of demarcation, which starts just behind the apex point of the circumvallate papillae and goes down to a point just above and in front of the base of the epiglottis This band is sometimes called the median glossoepiglottic ligament

Hypertrophy of the linguals is usually compensatory to a faucial tonsillectomy Most hypertrophies are found in adults It is most unusual to observe massive hypertrophies of the linguals in the presence of faucial tonsils Hypertrophies often reach tremendous size On several occasions, I have removed linguals the size of a large oyster The greater the hypertrophy the more prominent the fibrous line of demarcation between the two tonsils

Occasionally a child who has large faucial tonsils will have an associated hypertrophy of the linguals covering the entire base of the tongue, but these cases are not very common

Sometimes the linguals, in moderate hypertrophies, will creep laterally and form a thick sausage-like band along the lateral edge of the tongue, and fuse either with a lower pole tonsil stump, or the lower pole of a full faucial tonsil

The lingual tonsils are subject to the same diseases as the faucial tonsils, such as acute and chronic inflammations, hypertrophies, benign and malignant tumors, abscesses, varices, specific ulcers (tuberculosis and syphilis), Vincent's infections, mycotic infections, etc

SYMPTOMS

The average person with the small discrete lymphoid colonies at the base of the tongue, which really cannot be classified as true lingual tonsils, rarely has trouble with his throat and has little occasion to seek medical care

On the other hand, the individual with moderately enlarged colonies, forming two distinct masses, and the individual with the huge hypertrophies, usually runs into a lot of trouble with throat complaints and often seeks medical care His infected linguals are usually missed by the family physician because he is not trained in mirror laryngoscopy The laryngologist often misses them because he is busy or indifferent If the laryngeal mirror is always used in examining throats, a true picture of the base of the tongue becomes evident

What are the commonest symptoms of these patients?

1 *Acute Lingual Tonsillitis* The same symptoms as with faucial tonsils, with the addition that the pain is lower, usually off center, and with sharp pains on swallowing, in the hyothyroid area This symptom of a stabbing pain low down in the neck is important

2 *Subacute Lingual Tonsillitis* Instead of the throat symptoms subsiding in three or four days, the patient's distress may continue three or four weeks

3 *Chronic Lingual Tonsillitis* These patients start with an acute lingual tonsillitis, the acuity of the symptoms subsides, but the patient has a dull sore throat that persists for weeks or months One of the residents in radiology at the Philadelphia General Hospital had a sore throat for 11 months A year ago, I destroyed his linguals by electrocoagulation and he has not had a single sore throat since

The patient with chronic lingual tonsillitis is really throat conscious and always has a dull ache and lumpy feeling when he swallows Some of the patients with large hypertrophies may have difficulty in swallowing food, or may have difficulty in swallowing liquids Some have no difficulty along these lines They have used all the gargles and medicaments prescribed by physicians and druggists, and will go on for months or years with their complaints unless the causative pathology is discovered and treated Even the acute and subacute cases complain bitterly of repeated attacks of sore throats year after year Some of the patients complain of frequent spel of hoarseness, and one can readily see how the laryngeal are is involved

In my collection of lingual tonsils, there are those remove from the throats of two stenographers, who, for 10 years i one case, and four years in the other, had repeated sor throats of long duration Besides being ill, they were alway worried about losing their positions, due to the time lost from their offices These two patients vouched for one thing—laryngeal mirrors were never used in any of their previous throat examinations Such patients feel miserable and deserve our help

In simple hypertrophies, with a low grade infection, the patient may complain of a feeling of fullness in the throat, and may have a hacking cough for years Patients with dry, irritative coughs are often treated for years by the internist, who always suspects incipient tuberculosis, or chronic bronchitis of unknown etiology, or an early bronchiectasis They are studied in hospitals, X-rayed and treated, but the cough remains

Early malignancies are sometimes found in patients who complain of severe pain on one side of the throat In these cases, the surface of a lingual tonsil will show a fissured or an ulcerated area, with a piling up of wart-like tissue around it The tongue should also be palpated with the finger in cases where malignancy is suspected A biopsy will usually make the diagnosis

Bleeding in patients with hemoptysis often results from ruptured varices at the base of the tongue, with or without the presence of lingual tonsils These hemorrhages may be mild or severe They are terrifying to the patient, and in all cases where lungs and esophageal varices can be ruled out, one should examine the base of the tongue for enlarged or ruptured varices

TREATMENT

1 In acute inflammations treat with sulfadiazine or penicillin, just as though you were treating faucial tonsillitis, also any other systemic treatment which you may deem necessary Advise patient of the presence of infected lingual tonsils and recommend the destruction of this tissue

2 In chronically inflamed and hypertrophied tonsils, there should be no medical treatment If the linguals are slightly enlarged, I recommend electrocoagulation, if huge, surgical dissection

TECHNIQUE OF ELECTROCOAGULATION

The pharynx and posterior portion of the tongue are surface anesthetized with 10 per cent cocaine solution Ten cc of 1 per cent procaine epinephrine solution are then injected into the tongue, 5 cc. on each side, just in front of the lingual tonsils Wait about five minutes or until the anesthesia has become effective, then start to electrocoagulate the linguals

I prefer a bipolar needle attached to long or short wave current, the long wave is a little smoother This procedure is better than electrocoagulation with a monopolar needle I sometimes use the latter at hospitals where the machine has no provision for bipolar connections

In using a bipolar needle, the needle is sunk into the tissue about one-sixteenth of an inch, the current is controlled with a foot switch, and the needle is moved to different spots on the tongue, until the entire base is coagulated

For those who do not own a short or long wave machine, the older type of galvanocautery may be used by bending a cautery tip, using a dull red heat on the needle point The galvanocautery produces more of a charring "cook" than does the long or short wave currents, and the depth of the coagulation cannot be controlled too well, also, where galvanocautery is used, the patients complain of more distress on swallowing postoperatively In general, this is a poor technique

In carrying out the procedure of coagulation, all of the linguals are destroyed at one sitting In the past, I have tried the technique of partial coagulation each week but found is unsatisfactory Instead of a sore throat each week over a number of weeks, one good sore throat for several days seems to be preferable If the coagulation is done carefully and the musculature of the tongue is not "cooked," the postoperative soreness is tolerable in most cases

The technique of handling the large hypertrophies is the procedure which I wish to emphasize In the past, an instrument known as Myles' lingual tonsillotome was introduced and laryngologists would snip pieces of lingual tonsils with this instrument The technique was comparable to the old and early technique of tonsillotomy — cutting off the top of the tonsil This method of using the Myles instrument is to be condemned for two reasons

1 It is incomplete and, therefore, a waste of time

2 It may induce profuse bleeding, as in tonsillectomy The cut blood vessels within the lymphoid tissue have no fibrous or muscle tissue to contract down on the cut ends of the small blood vessels

A lingual tonsillectomy, like any surgical operation, should be based on sound principles

The tongue tonsils are fairly tough tissue, the basement membrane is tough, and the linguals in the huge hypertrophies extend practically to the base of the epiglottis and are large in size I cannot see how the Myles lingual tonsillotome, just from a mechanical point of view, could do a complete and smooth operation

The armamentarium of lingual tonsillectomy is simple and consists of four instruments

1 A Kirkpatrick tonsil tenaculum with *small teeth*

2 One Tyding tonsil snare

3 One stainless steel Metzenbaum scissors

4 One laryngeal mirror

The tongue is anesthetized as for coagulation — 10 per cent cocaine swabbing and injection of 10 cc. of 1 per cent procaine epinephrine into the tongue.

The tip of the tongue is grasped with a gauze square and drawn forward The left lingual tonsil is grasped with the tenaculum and the nurse or assistant then grasps the tongue, and also holds a laryngeal mirror under the uvula and soft palate The operator shifts the tenaculum to the left hand and begins to cut with the long, heavy, curved scissors, starting anteriorly at the circumvallate papillae The line of dissection should be between the musculature of the tongue and the fibrous capsule of the lingual tonsil The latter separates readily from the tongue. The dissection is followed down as far as possible toward the base of the epiglottis The Tyding snare is then slipped over the posterior attachment of the lingual tonsil, the instrument is closed firmly and the tonsil is thus removed

This procedure is repeated on the opposite side Sometimes in certain cooperative patients it is not even necessary to use the snare, as the scissors will often take off the posterior attachment without any trouble If the snare is used, press the wire flat against the attached end of the tonsil and close gently but firmly *In this fashion, you cannot injure the* epiglottis

The laryngeal mirror has to be removed a few times during the operation to be cleansed and warmed Occasionally, if the hypertrophy is extensive, enough of the tonsil is visible at all times to enable the operator to dispense with the mirror

In some of the cases, the linguals have to be removed piecemeal, as the patient may not be cooperative, or the linguals may be very adherent from chronic infection, just as in faucial tonsils, where the latter have to be removed in pieces

If small tags of lymphoid tissue remain after the operation, they are coagulated with the electric needle to complete the operation

At the time of operation, there is no undue bleeding if you allow five to seven minutes between the injection of procaine and the beginning of the operation

Postoperatively, the bleeding is usually negligible Laryngologists in the past have been loath to operate on the base of the tongue for fear of the old "bugbear," severe hemorrhage My experience has been that patients with lingual tonsillectomies bleed less postoperatively than do patients with faucial tonsillectomies

I have had but one patient with an actual hemorrhage following lingual tonsillectomy which required suturing about six hours after the operation The bleeding was at the edge of the tongue, where I had severed scarred and retracted faucial pillars and a faucial tonsil stump attached to the lingual Two other patients have had slight oozes which were easily controlled with mild astringents, therefore, I may safely advise proceeding with lingual tonsillectomies, using the methods I have described, without fear of unusual bleeding, either during or after the operation

In patients having hemoptysis which you think is due to lingual varices, coagulate the varix with a bipolar needle or one of the other coagulating needles described If the varices are associated with hypertrophied linguals, it is advisable to destroy or remove the linguals

Malignancies at the base of the tongue are treated like malignancies elsewhere in the pharynx

There is one anomalous condition which the operator must be careful in diagnosing, and that is the aberrant thyroid which is usually located at the base of the tongue directly in the center An aberrant thyroid is really a misplaced thyroid, is present at birth, and may increase in size with the growth of the child It is a hard, smooth, elevated mass, like a small egg, and is not made up like the grouping of discrete lymphoid nodules in the linguals The accidental excision of an aberrant thyroid may turn the individual into a victim of hypothyroidism

Another pathological process which may strike the lingual tonsil is a lingual quinsy or abscess These are indeed rare, and if they should occur would require incision and drainage

CONCLUSION

1 Always use a laryngeal mirror in examing new patients Ninety-eight per cent of hypertrophied or diseased linguals will not be seen unless a mirror is used

2 Hypertrophied and diseased lingual tonsils should always be destroyed

3 Use coagulation if linguals are not large enough to be grasped with a tenaculum, and surgery, if large enough

4 The two procedures are not painful if the tongue is properly infiltrated with a local anesthetic

5 The bleeding during operations is usually negligible

6 Postoperative bleeding is usually less than after faucial tonsillectomy and certainly no worse

7 Sense of taste may be impaired for a short time in a few cases, then returns

8 The patients are very grateful, many having suffered over long periods of time with all kinds of bizarre diagnoses

9 The laryngologist develops a certain sense of satisfaction first, in making the proper diagnosis, second, in helping the patient

6330 Lebanon Avenue

SCLEROMA SIMULATING ATROPHIC RHINITIS CLINICAL DIFFERENTIATION AND LABORATORY CONFIRMATION *

MANUEL R WEXLER, M D ,
Los Angeles, Calif

Scleroma (rhinoscleroma) in its early stage presents a picture similar to atrophic rhinitis This fact has been shown by Szmurlo,[1] who has made extensive studies of the disease, and by Putschkowsky,[2] as described in Eggston and Wolff [3]

That early cases of scleroma may be diagnosed and treated as atrophic rhinitis occurred to us while treating a series of three cases of scleroma at the Los Angeles County Hospital

Clinically, we are all familiar with the atrophic nose These patients usually have a broad, flat nose with large nasal cavities and small turbinated bones The nares are usually filled with crusts and a foul, green, purulent discharge, and when the nose is cleaned of its crusts and discharge the large cavernous nasal cavity is seen In scleroma the crusting and foul smelling discharge is very much like that seen in atrophic rhinitis, but here is where the similarity ceases, for, upon removal of the crusts and purulent secretion, the nasal cavities, instead of being large, are usually narrowed and the mucosa is reddened, giving one the impression of its being infiltrated with a hard, firm substance When the tissue is palpated with an instrument this impression is confirmed

---

*From the Department of Otolaryngology University of Southern California School of Medicine and the Los Angeles County Hospital

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 26 1949

This is the essential clinical finding It is the responsibility of the examining physician to rule out scleroma The final diagnosis is based on pathological and bacteriological findings and, if available, a complement fixation reaction[4]

In obtaining the biopsy it is important to examine the nose well and choose an area that appears infiltrated and, if possible, a nodule or granulomatous area is preferred

That various stages of the disease may be present in the same individual at the same time was found early in our experience with this disease, and men who have done extensive pathological studies of scleroma state that the disease can be diagnosed best when the stage in which the typical Mikulicz cells, russel bodies, etc , are present, and this is usually the second or the circumscribed stage When these features are not present, such as may occur in the early or very late stages, repeated biopsies may be indicated, however, a biopsy from a nodule or granulomatous area will most likely give you the typical microscopic picture

The bacillus of von Frisch or K. rhinoscleromotis is the organism thought to be responsible for the disease and is present in the Mikulicz cell The organism when present will grow very readily on almost any type of media and will overgrow most of the other organisms present Pearson[5] believes that the organism is not present in the bacterial flora of the normal nose, as has been stated by some, and when present is definitely pathological

In obtaining a smear, an ordinary swab of the mucosal surface after the crusts have been removed is usually sufficient Occasionally we have obtained a positive culture in questionable cases by sending a fresh piece of mucosa to the bacteriology department where the tissue is crushed and a culture made Because we have obtained at least one or more positive cultures by this method I would recommend that this be done when a positive culture cannot be obtained by direct smear alone.

Another interesting point about the bacillus of Frisch is that it is unusually sensitive to streptomycin, and there has been at least one report of a cure with streptomycin We presented three cases before the Oto-Ophthalmological Section of the Los Angeles County Medical Association, in 1946, which were treated with streptomycin and at least obtained spectacular immediate relief

We examined all old cases of atrophic rhinitis, and the new cases reporting to the clinic, from the standpoint that they may be scleroma in its early stage From January, 1946, to January, 1948, 27 cases of atrophic rhinitis were examined, and the routine of biopsy and smear for scleroma was done on all cases, including three cases of atrophic rhinitis following extensive surgery of the nose The diagnosis of scleroma was considered positive when the pathological report and the culture were both positive Seven cases met these criteria

This we realize is a very high percentage, and the fact that most of the patients were Mexicans and that Los Angeles may be an endemic area for the disease has been considered, nevertheless, these findings substantiate the statement made previously in this paper that early cases of scleroma may be mistaken for atrophic rhinitis

SUMMARY

1 Early scleroma may simulate atrophic rhinitis, and may be diagnosed and treated as such unless a biopsy and smear are taken for more detailed laboratory examination

2 The differential diagnosis is extremely important at this time, since there is a drug that is specific for the organism thought to be responsible for the disease of scleroma

3 As the result of special study, at least seven cases of scleroma were diagnosed in a period of two years at the ear, nose and throat clinic of the Los Angeles County Hospital that would otherwise have been considered atrophic rhinitis

---

The author respectfully acknowledges the encouragement in pursuance of this problem and aid in preparation of this paper given by Dr J M Brown and Dr H R. Fisher

REFERENCES

1 Szmurlo J Anatomicopathology of Scleroma *Arch Otolaryngol* 18 393 1933

2 Putschkowski, A Zur Pathologic des Skleroms der oberen Luftwege *Ztschr f Hals, Nasen u Ohrenh*, 32 265 1932

3 Eggston and Wolff Histopathology of the Ear Nose and Throat Williams & Wilkins 1947 pp 717 719

4 Levine, M G and Hoyt, R. E *Arch Otolaryngol*, 47 438 Apr 1948

5 Pearson, H E Personal communication

6 New, G B *et al* *Ann Otol, Laryngol and Rhinol* 57 412 June 1948

CENTRAL ILLINOIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

The next meeting of the Central Illinois Society of Ophthalmology and Otolaryngology will be held at the Abraham Lincoln Hotel in Springfield, Ill, on Nov 18, 19 and 20 Dr Wm Benedict, of the Mayo Clinic, will give lectures on "Cataracts and Systemic Diseases," "General Diseases Ocular Manifestations" and "Tumors of the Eye and Orbit" Dr H P House, associate professor of otolaryngology at the University of Southern California, will speak on the following Indications and End-Results of Fenestration Surgery, Management of Otitis Media and Management of the Continually Stuffy Nose Dr Walter E Owen, Peoria, Ill, a member of the Society, will speak on Drug Therapy in Respiratory Allergy Dr Herbert M Kobes, director of the University of Illinois, Division of Services for Crippled Children, will speak on the "State of Illinois Cooperates with the Ophthalmologist and Otolaryngologist"

THE TREATMENT OF CHRONIC PURULENT OTITIS MEDIA WITH GLYCERITE OF HYDROGEN PEROXIDE

WALTER E OWEN, M D ,
Peoria, Ill

In a preliminary report[1] the results achieved in 37 cases of chronic purulent otitis media treated with glycerite of hydrogen peroxide were recorded Of this original group of patients, 29 responded with completely dry ears Eleven returned with exacerbations due, in nine, to an acute upper respiratory tract infection, and, in two, following swimming These were treated as previously with similar satisfactory results In one patient, in whom a severe exacerbation occurred, a radical mastoidectomy was required Twelve other patients of the original series have been seen for other complaints and have reported no recurrence of their ear infection since their first course of treatment

The present paper is concerned with 130 additional cases seen over a period of two years, during which time the limitations and indications for the use of glycerite of hydrogen peroxide have become more clear It cannot be expected that the solution will cure cases in which there are attic perforations with cellular debris in the mastoid antrum, or when large cholesteatomatous masses are present Results have not been satisfactory in patients with concomitant Eustachian tube infection, unless these were treated and made free of infection Otherwise, the results achieved appear worthy of serious consideration

---

Editor s Note This ms received in Laryngoscope Office and accepted for publication Feb 11 1949

The solution used consists of hydrogen peroxide* (1 5 per cent) (derived from urea peroxide, 4 per cent) in anhydrous glycerol, containing as well eight hydryxyquinoline (0 1 per cent), added for stabilization purposes The bacterial spectrum of glycerite of hydrogen peroxide with carbamide has been reported upon,[2] as well as its effect on healing time [3]

Method of Treatment

In each case, the patient was instructed to cleanse the ear mechanically once daily and to instill the glycerite of hydrogen peroxide with carbamide twice to four times daily The material for culture was taken on the first visit and the patients were seen for examination at varying subsequent periods

Laboratory Data

The laboratory data can be summarized as follows In eight patients, no cultures were taken, of the rest, almost all showed mixed infections *Staphylococcus, albus* and *aureus*, were reported as present, alone or together in 85 cases *Proteus mirabilis* was present in 26 patients, and a Gram-negative bacillus was reported in 24 A nonhemolytic streptococcus was cultured from 20 patients, *Esch coli* from 16, *Ps pyocyaneus* from 14, diphtheroids from 13, and a hemolytic steptococcus from 10 Ten other organisms were cultured fewer than 10 times each

Clinical Data

For the duration of their infection, 50 patients, varying in ages from nine to 60, had stated "since childhood" For the remainder, allowing for approximation and computing weeks to the nearest month, and months to the nearest year, 11 patients had a history of one month's duration, 13 for two months, two for three months, one for four months, six for six months, one for 10 months, three for one year, 10 for two years, six for three years, 12 for five to 10 years, and

---

*The glycerite of hydrogen peroxide with carbamide was supplied, in part, by the International Pharmaceutical Corp Boston Mass

15 for 10 to 25 years Almost all the patients presenting years of symptoms had had some previous treatment with little or temporary effect, and some therapeutic as well as spontaneous remissions of varying duration

All ages were represented, with 24 patients under the age of 10, and for each successive decade, 10 to 19, 27 patients, 20 to 29, 32 patients, 30 to 39, 18 patients, 10 to 19, 19 patients, 50 to 59, eight patients, and above 60, two patients

Clinical Results

Since each of the detailed protocols for the entire series cannot be presented individually, the results can be summarized in four categories the patients in whom the treatment failed, those in whom auxiliary medical or surgical treatment was necessary, those still under treatment and apparently improving, and those in whom the treatment was completely successful

In all, 14 patients failed to return for further observation Although some were markedly improved during the period of treatment, none can be used for statistical purposes, since there may have been others who showed no improvement with the topical application prescribed

Complete failure is reported in five patients, and partial failure in two more One of the five took treatment regularly for three months for a condition of four months' duration, and a second (age 19) attended irregularly for six months for an infection present since infancy A third patient presented an infection of 16 years' duration, the culture demonstrating Gram-negative bacilli and proteus mirabilis There was no change in culture and no response to treatment over a period of more than two months

A fourth patient (age 18), with an infection present since childhood, with polypi and a chronic sclerotic mastoid, refused surgery and has continued treatment to no avail The fifth patient (aged 24), with an infection also present since childhood, with large cholesteatomata (revealed by X-ray), also refused surgical interference Although with treatment the drainage was less and the odor diminished, the discharge was, nevertheless, present, although under active treatment The sixth patient presents a slight persistent drainage, and the seventh, who had had coronary disease and cannot undergo surgery, keeps the discharge and fetid odor under control with daily applications of glycerite of hydrogen peroxide The latter two patients are considered as partial failures in treatment

There were 12 patients who required exceptional treatment Of these, a recurrence, following cessation of drainage, occurred in four In one, the discharge had been present for two years, and in three others, since childhood The first and second patients in this group ceased treatment for approximately nine months and then suffered from recurrences, which, however, cleared completely with four weeks of treatment The third patient had a recurrence in four months Remissions followed one month of treatment. The fourth had a recurrence, both in nine months and 11 months, following the initial remission, clearing each time and remaining free of discharge from December, 1947, to date (June, 1948)

In the eight additional patients of this group who required auxiliary treatment, three represented infections present since childhood, one (age 32) for "many years", three, respectively, for six, 10 and 25 years, and one for only five weeks Of these, one required a polypectomy and after improving for one month of treatment did not return for three months, at which time the discharge was heavy and associated with unilateral pain and cerebral symptoms requiring a mastoidectomy and treatment for a temporal brain abscess Treatment with glycerite of hydrogen peroxide with carbamide was continued for five months from the date of the first visit The ear was reported as dry

The second required removal, first of a polyp, and then of a cholesteatoma. He returned six months later, at which time a radical mastoidectomy was done Glycerite of hydrogen peroxide with carbamide was continued for nine months from the date of the first visit, the ear was reported as dry The third patient in this group followed a similar pattern, requiring polypectomy, removal of a cholesteatoma and then a mastoid over a period of two months Freedom from infection was reported in July, with a recurrence during the following February (1947) In March, the ear was dry and has since remained so, more than one year following the initial visit

The conditions of the fourth and fifth patients were associated with an acute mastoiditis requiring intramuscular penicillin, oral sulfonamides and local glycerite of hydrogen peroxide with carbamide for three weeks and one month, respectively, before complete remission occurred One other patient required penicillin as well as glycerite of hydrogen peroxide with carbamide, a seventh was treated for a concomitant purulent right antrum and an allergic rhinitis The last patient in this group needed radical mastoidectomy for a large cholesteatoma He was discharged in complete remission, but returned with a large infected mass in the old mastoid cavity Removal and local treatment for a *Staphylococcus albus* infection was necessary for 15 days before the condition completely cleared

Three patients still under treatment are showing improvement with slight discharge present but diminishing

The remaining 94 patients, of whom eight had bilateral infected ears, all completely cleared with topical application of glycerite of hydrogen peroxide with carbamide as described above In five, the treatment period was one week, for 30, two weeks, for 24, three weeks, for 16, four weeks, for four, five weeks, for one, six weeks, for four, seven weeks, and for six, eight weeks Two patients required 10 weeks of treatment and one patient, 12, and another, 16 weeks of continuous application Of the 94 patients, however, 75 were in complete remission by the end of the fourth week

SUMMARY

In summary, 130 patients were seen presenting conditions diagnosed as chronic purulent otitis media Of these, 11 failed to return, 12 required auxiliary medical or surgical treatment

for recurrences of concomitant conditions before their infection completely cleared Of these, four required more than one course of treatment In five, the treatment completely failed In two others, there is little remaining persistent discharge Three patients still under treatment are showing improvement In the remaining 94, there were complete remissions for treatment periods varying from one to 16 weeks, 75 of the patients presenting dry ears in four weeks of topical application of glycerite of hydrogen peroxide with carbamide

In all, adding those who required one course of treatment (94) to those who needed two or more courses (four), with the eight in whom surgical or supplementary medical treatment was necessary, a total of 106 patients, of the 116 adequately treated, presented remissions of their purulent otitis media All were treated with glycerite of hydrogen peroxide with carbamide and in none was there evidence of toxicity, sensitivity or irritation

REFERENCES

1 BROWN ETHAN ALLAN, OWEN WALTER E Treatment of Chronic Purulent Otitis Media with Glycerite of Hydrogen Peroxide (A Preliminary Report) *Arch Otolaryngol* 43 605 612 1946

2 BROWN, E A. KRABEK W and SKIFFINGTON R. A New Antiseptic Solution for Topical Application *N Eng Jour Med* 234 468 472 Apr 1946

3 JENKINS JAMES T Effect of Glycerite of Hydrogen Peroxide Upon Healing Time in Anorectal Surgery *Amer Jour Surg* 54 4 428 430 Oct 1947

1242 Jefferson Building

SECOND PAN AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY— MONTEVIDEO-BUENOS AIRES, JAN 8-15, 1950

EXECUTIVE COMMITTEE

President Prof Justo M Alonso

Vice-Presidents Prof Elias Regules, Dr Juan Carlos Munyo, Prof Juan Carlos Oreggia

Secretary General Prof Pedro Regules

Secretary of Interior Prof Hector Rebagliatti

Secretary of Exterior Dr Julio Cesar Barani

Secretary of Exhibit Dr Enrique Apolo

Secretary of Publicity Dr Jaime Sala Lopez

Treasurer Dr Alberto Santoro Vecino

Assistant Treasurer Dr Juan Carlos Munyo, Jr

Delegate in Argentine Republic Prof Juan Manuel Tato

Delegate in Mexico Dr Ricardo Tapia Acuña

Delegate in Cuba Dr Pedro Hernandez Gonzalo

Delegate in the U S A and Canada Dr Chevalier L Jackson

An interesting and instructive program has been arranged

Subscription—$10, or its equivalent in Uruguayan money

The following week (Jan 16-21) there will take place in Montevideo and Buenos Aires, operative demonstrations for those who wish to attend

Travel arrangements should be made immediately through Thomas Cook & Sons or Pan American Airways

All those interested in attending this Congress should communicate at once with the delegate in the U S A and Canada Dr Chevalier L Jackson, 3401 North Broad Street, Philadelphia 40, Pa

THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

The coming Section Meetings of the American Laryngological, Rhinological and Otological Society, Inc , are to be held as follows

Eastern Section Hotel Statler, New York, N Y , Jan 5, 1950

Council Meeting Hotel Statler, New York, N Y , Jan 6, 1950

Combined Meeting, Southern and Middle Sections Peabody Hotel, Memphis, Tenn , Jan 16-17, 1950

Western Section Medical Society Building, Los Angeles, Calif , Jan 21-22, 1950

The 1950 Spring Meetings will be held at the Hotel Mark Hopkins in San Francisco, Calif , as follows

American Board of Otolaryngology, May 16-20, inclusive

American Otological Society, Inc , May 21-22

American Laryngological Association, May 23-24

The American Laryngological, Rhinological and Otological Society, Inc , May 25-27, A M

The American Broncho-Esophagological Association, May 25-26, P.M

Please make your Hotel Mark Hopkins reservations at once by writing to Mr Carl J Wilson, Assistant Manager, San Francisco Convention and Tourist Bureau, 200 Civic Auditorium, San Francisco, Calif , and enclose a deposit of $10 made payable to the Hotel Mark Hopkins In return you will receive a hotel reservation confirmation The limited facilities available make early reservations important

Members and guests desiring to go on special Pullman cars "with the gang" should write immediately to Dr Walter H Theobald, 307 North Michigan Avenue, Chicago 1, Ill , Chairman of the Transportation Committee

Dr C Stewart Nash, Secretary

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp, 580 Fifth Ave, New York 19, N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St., Chicago, Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac, Beltone Symphonette

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St., Chicago Ill.

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co, Inc., 10 East 43rd St, New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc, 50 W 29th St., New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co, Inc, North Third St., Minneapolis, Minn.

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp, 1 W 34th St., New York N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co, 727 Atlantic Ave Boston 11 Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic.

Manufacturer Microtone Co, 4602 Nicollet Ave Minneapolis 9 Minn.

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories, 815 S Hill St., Los Angeles 14 Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4

Manufacturer Otarion Hearing Aids 159 N Dearborn St. Chicago Ill.

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)

Manufacturer Paraphone Hearing Aid Inc. 2056 E. 4th St. Cleveland Ohio

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone, Radioear Permo-Magnetic Multipower

Manufacturer E. A. Myers & Sons 306 Beverly Rd. Mt. Lebanon Pittsburgh Pa.

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp 6001 W Dickens Ave., Chicago Ill.

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp 101 Tremont St. Boston 8 Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp Elmsford N Y

Superfonic Hearing Aid

Manufacturer American Sound Products Inc 2454 S Michigan Ave., Chicago Ill

Televox Model E

Manufacturer Televox Mfg Co, 117 S Broad St Philadelphia 7, Pa

Telex Model 22, Telex Model 97, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550, Telex Model 1700

Manufacturer Telex, Inc, Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters, Inc, 1627 Pacific Ave, Dallas 1, Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm, Inc, 400 W Lake St, Libertyville, Ill

Unex Model "A", Unex Midget Model 95, Unex Midget Model 110

Manufacturer Nichols & Clark, Hathorne, Mass

Vacolite Model J

Manufacturer Vacolite Co 3003 N Henderson St, Dallas 6, Tex

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc 120 Broadway, New York 5, N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75

Manufacturer Zenith Radio Corp, 6001 Dickens Ave, Chicago, Ill

All of the accepted hearing devices employ vacuum tubes

TABLE HEARING AIDS

Precision Table Hearing Aid *Jour A M A*, 139 785-786, March 19, 1949

Manufacturer Precision Electronics Co, 850 West Oakdale Ave Chicago 14 Ill

Sonotone Professional Table Set Model 50 Report not yet published

Manufacturer Sonotone Corp Elmsford N Y

All of the Accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer, 20 Charlesgate, West Boston 15 Mass
Secretary Dr Gordon D Hoople, Medical Arts Bldg Syracuse 3 N Y
Meeting Mark Hopkins Hotel San Francisco, Calif. May, 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A. Fenton 906 Medical Arts Bldg Portland Ore
Secretary Louis H. Clerf 1530 Locust St. Philadelphia 2, Pa.
Meeting Mark Hopkins Hotel San Francisco, Calif May 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin, 384 Post St. San Francisco 8 Calif
Secretary Dr C Stewart Nash, 708 Medical Arts Building Rochester N Y
Meeting Mark Hopkins Hotel, San Francisco Calif. May 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

Eastern Section, Hotel Statler New York N Y., Jan 5 1950
Council Meeting Hotel Statler New York City Jan. 6 1950
Combined Meeting Southern and Middle Sections Peabody Hotel Memphis Tenn. Jan. 16-17 1950
Western Section, Medical Society Bulding Los Angeles Calif. Jan. 21 22 1950

AMERICAN MEDICAL ASSOCIATION SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward 104 E Market St Charlottesville Va
Secretary Dr James M Robb 641 David Whitney Bldg Detroit Mich.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Conrad Behrens 35 E 70th St New York, N Y
President Elect Dr J Mackenzie Brown 1136 W 6th St Los Angeles Calif
Executive Secretary Dr William L. Benedict Mayo Clinic Rochester Minn.
Meeting Palmer House Chicago Ill Oct 9 14 1949

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley, 384 Post St, San Francisco, Calif

Secretary Treasurer Dr Joseph Hampsey, 806 May Bldg, Pittsburgh 2 Pa.

PAN AMERICAN ASSOCIATION OF OTO-RHINO-LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L Jackson, 255 S 17th St., Philadelphia Pa.

Second Pan American Congress of Oto Rhino-Laryngology and Broncho-Esophagology *Montevideo, January, 1950*

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President Dr LeRoy A. Schall, 243 Charles St., Boston, Mass

Secretary Dr Edwin N Broyles, 1100 N Charles St. Baltimore 1 Md

Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Warren A. Wilson

Secretary Treasurer Dr Victor Goodhill

Chairman of Section on Ophthalmology Dr George Landegger

Secretary of Section on Ophthalmology Dr Harold B Alexander

Chairman of Section on Otolaryngology Dr Alden H Miller

Secretary of Section on Otolaryngology Dr Leland R House

Place Los Angeles County Medical Association Bldg, 1925 Wilshire Blvd, Los Angeles, Calif

Time 6 P.M, fourth Monday of each month from September to May, inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner, 115 E 61st Street, New York 21 N Y

Secretary D Smith, 291 Whitney Avenue New Haven 11 Conn

W EMY OF OPHTHALMOLOGY RYNGOLOGY

Dr Jes Town W V

resl Clair, Jr Bluefield W Va

Pres , Charleston W Va

r Eleventh St Hunting

W Va.

T re W Va. Dr

Di er

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave North Nashville 3, Tenn.

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg Atlanta 3 Ga.

Vice-Chairman Dr V R. Hurst, 315 N Center St. Longview, Tex.

Secretary Dr Alston Callahan, 908 S Twentieth St., Birmingham 5 Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St., Philadelphia Pa.

Vice-President Dr Thomas F Furlong Jr 36 Parking Plaza Ardmore Pa.

Treasurer Dr Harry P Schenck, 1912 Spruce St. Philadelphia, Pa.

Secretary Dr William J Hitschler, 5 E. Chestnut Hill Ave. Philadelphia 18, Pa.

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA.

Presidente Dr Reinaldo de Villiers
Vicepresidente Dr César Cabrera Calderin
Secretario Dr José Xirau.
Tesorero Dr Alfredo M. Petit.
Vocal Dr José Gross
Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa.
Librarian-Treasurer Dr Leoncio de Souza Queiroz.
Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha.

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA.

Presidente Dr Aldo Remorino
Vice-Presidente Dr Luis E. Olsen.
Secretario Dr Eugenio Romero Díaz.
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez Dr Nondier Asís R., Dr Jorge Bergallo Yofre.

BUENOS AIRES CLUB OTORINOLARINGOLOGICO

Presidente Dr Juan Manuel Tato
Vice-Presidente Dr Norberto Von Soubiron
Secretario Dr Oreste E. Bergaglio
Pro-Secretario Dr Carlos A Gutierrez
Tesorero Dr Vicente R. Carri
Pro-Tesorero Dr Jorge Couzo

A safe, simple Mouth Gag for Tonsillectomy

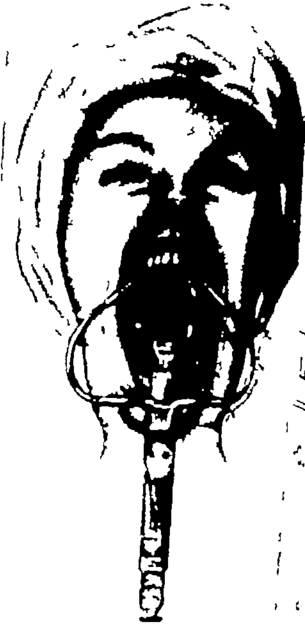
Hazards of trauma to the incisor teeth by the usual mouth gag are eliminated by this simple instrument

CONTACT is placed behind the canine teeth The instrument provides better exposure and fits any mouth from small child to adult Easily adjusted from side to side, always with two-point contact Three sizes of tongue blades are provided The contact portion of the ring is covered with small rubber tubing, as an added protection This gag may be used on edentulous patients

The new Atraumatic Mouth Gag, of fine material and workmanship, with three sizes of tongue blades COMPLETE $25 00

Consult your Dealer or write to

THE ATRAUMATIC COMPANY 418 30th Street OAKLAND 9 CALIFOR



UNIVERSIDAD NACIONAL DE MEXICO
ESCUELA DE GRADUADOS
— División de Medicina —
CURSO DE OTORRINOLARINGOLOGIA
Y BRONCO ESOFAGOLOGIA
Para Médicos
Jefe del Curso y Professor de
Otorrinolaringología
DR ANDRES BUSTAMENTE GURRIA
Profesores Asociados y Jefes de Clínica
Drs PEDRO BERRUECOS RAMON DEL
VILLAR y Roberto SANCHEZ
Secretario del Curso:
Dr Humberto ALCOCER
El Curso se llevará a cabo en el INSTITUTO NACIONAL DE CARDIOLOGIA y en los HOSPITALES MILITAR e INFANTIL
Fecha del 10 al 29 de octubre
CUOTA $500 00
Inscripciones e Informaciones Queretaro 97, Mexico, D F
Matricula limitada a 18 alumnos
"Por mi Raza Hablara el Espiritu"
El Director de la Escuela
DR JOSE ZOZAYA
México, D F

Books Received

New Gould Medical Dictionary A [illegible] comprehensive dictionary of terms [illegible] branches of medicine and allied [illegible] medical physics and chemistry [illegible] nursing veterinary medicine [illegible] well as medicolegal terms [illegible] tables Edited by Harold Welles [illegible] Normand L Hoerr M D Arthur [illegible] the cooperation of an editorial [illegible] tributors Two hundred fifty [illegible] plates 129 in color First [illegible] The Blakiston Co 1949

THE
LARYNGOSCOPE.

VOL LIX OCTOBER, 1949 NO 10

SURGICAL TREATMENT OF MENIERE S DISEASE *†

FRANZ ALTMANN, M D ,
New York, N Y

Operations on the labyrinth are the oldest form of surgical treatment for the relief of vertigo in Meniere's disease They were in practice long before the exact anatomical basis for the disease had become clearly known Knapp (1871) was the first to suspect increased intralabyrinthine pressure as the cause of the symptoms of Meniere's disease Following him, Cheatle (1897) recommended decompression of the perilymphatic space as possible treatment of the condition, a suggestion which was later carried out by Jenkins in 1911 Meanwhile, opening and destruction of the labyrinth was first practiced by Milligan and by Lake (both in 1904) By 1930 about 50 cases had been reported in which the vertigo was successfully treated in this way The majority of the otologists, however, rejected destruction of the labyrinth, mainly because of the danger of postoperative complications and because of the lack of exact knowledge of the pathology of the condition This viewpoint is clearly reflected in Uffenorde's (1925) discussion of the subject In the handbook

---

*Presented in part at the meeting of the Section on Otolaryngology New York Academy of Medicine April 20 1949

†From the Department of Otolaryngology Columbia University College of Physicians and Surgeons and the Presbyterian Medical Center

Editor s Note This ms received in Laryngoscope Office and accepted for publication May 20 1949

edited by Denker-Kahler (1928) the possibility of surgical treatment of Ménière's disease is not mentioned It seems that the danger of these operations had been greatly overestimated by the contemporary authors, there were remarkably few postoperative complications, and not one death reported attributable to the operation

Since chemotherapy and the use of antibiotics have remarkably reduced the suspected or actual dangers of opening a living- noninfected labyrinth, the interest in labyrinthine surgery was greatly increased A great stimulus was also given by the clarification of the clinical and anatomical picture of the disease

It was recognized gradually that among the diseases which have the symptom of peripheral vestibular or labyrinthine vertigo in common, one group stands out clearly by its well defined sypmtomatology This group alone deserves the name of "Ménière's disease," whereas all the other conditions constitute the large group of cases presenting "Meniere's syndrome"

True Menière's disease is briefly characterized by attacks of peripheral vestibular or labyrinthine vertigo, reduced hearing and, in most instances, tinnitus, without any active disease of the middle ear or evidence of any other disease The tinnitus is low-pitched and roaring or high-pitched, ringing or hissing in character

The attacks of vertigo are characteristically paroxysmal and occur usually when the hearing loss and the tinnitus have reached their maximum intensity, but sometimes the vertigo occurs after the hearing has begun to improve The intervals between the attacks are of various length, during which the vestibular symptoms usually disappear completely and the hearing improves, but the tinnitus may persist, particularly if it is of the low-pitched variety The condition lasts for many years, sometimes throughout life The dizzy spells disappear eventually in many cases, but the hearing loss is progressive The tinnitus usually persists longer than all other symptoms

The functional status of the diseased vestibular apparatus shows fluctuations It is lowered in the later stages of the disease and particularly during the attacks In the intervals between the attacks, central regulatory processes compensate for the difference in the functional status of the two labyrinths During the attacks the equilibrium is again upset, the attacks may recur as long as the diseased labyrinth shows even the slightest amount of function

The threshold of hearing shows wide fluctuations, particularly in the lower and middle ranges During the attacks the thresholds drops sharply but may go back to normal, particularly in the early stages of the disease In more advanced cases the fluctuations become less marked, and the hearing loss does not return to normal or improve markedly in the intervals between the attacks A permanent and progressive hearing loss develops which is frequently, but not always, more marked in the lower and middle ranges or extends more uniformly over the entire tonal range In cases in which the disease starts in the middle age or later, a high tone loss may already be present at the time of the onset, however, this high tone loss is not related to the disease In advanced cases the hearing loss may become very marked, but in rare instances only is it complete In our experience, recruitment of loudness is frequently, but not always, present A sense of blockage in the affected ear and intermittent diplacousis binauralis dysharmonica, a disturbance in which the same tone is heard at a different pitch in both ears, are frequent findings

The clinical picture has a satisfactory explanation, through the findings in autopsy material They show dilatation of certain parts of the endolymphatic labyrinth, a so-called endolymphatic hydrops The changes in the end-organs are difficult to evaluate, it seems that the attacks cause a temporary compression of Corti's organ with transient and, to a certain extent, reversible changes in the hair cells, it is not improbable that similar changes, perhaps less evident, might also occur in the other end-organs

According to Mygind and his school, not all the cases of Meniere's disease present the picture of endolymphatic hydrops. In many of them one must assume the presence of what he calls "endolymphatic compression" resulting from an overpressure in the perilymphatic system. This first stage might be followed by endolymphatic dilatation. Mygind quotes the histologically examined cases of Videbech and Arnvig as samples of Méniere's disease with endolymphatic compression. The case of Videbech, however, does not show the characteristic clinical picture of true Meniere's disease. It neither proves nor disproves Mygind's theories. The history in Arnvig's case is not detailed enough to establish beyond doubt the diagnosis of true Meniere's disease. If the endolymphatic dilatation is really the second stage of a process which begins with endolymphatic compression, it would be hard to understand why, in a patient with a clinical history dating back for 40 years and with repeated attacks of dizziness for the last 25 years, the histological changes should not have gone beyond the first stage.

As long as more convincing evidence to the contrary is not presented, one must regard endolymphatic hydrops as the anatomical basis of true Meniere's disease. It is, however, probable that in the early stages of the disease the endolymphatic system regains its original shape after the attack. Later, the distension becomes permanent, although the endolymphatic pressure returns to normal. Mygind's opinion "that there is no borderline between Meniere's disease and, on one side, all the labyrinthine complications that may arise in connection with *middle ear lesions* and, on the other side, a number of endocranial affections with labyrinthine phenomena" is misleading and not confirmed by the histological findings in typical cases of Meniere's disease. The latter should rather be regarded as disease *sui generis* unrelated to other conditions with a more or less similar symptomatology.

Unless this sharp distinction is *maintained* it is very difficult to evaluate the efficacy of treatments used in condition A proper evaluation is, however, of the greatest importance, because it is obvious that surgical treatment should be considered only after medical treatment has proven ineffectual

Cases which clearly show the clinical picture of Menière's disease are not too frequent in my experience The very large series of cases supposedly observed by some authors within a relatively short period of time might be due to a less strict selection Another point which is easily forgotten is that the untreated cases of Menière's disease show a tendency to spontaneous remissions with return of the hearing to the previous level and, often, disappearance of the tinnitus within a few weeks, the remissions may last for many years The attacks of dizziness eventually become weaker spontaneously, no matter what treatment is used and finally disappear completely

Judging from my own experience and that of our department, I am unable to share the optimism of many authors concerning the chances for a permanently and completely successful medical treatment of fully developed cases of Memeres' disease except the rare bilateral cases where streptomycin achieves an incomplete or complete loss of function of the vestibular portions of both labyrinths In the great majority of cases of true Menière's disease followed in our department during the last years, surgical treatment has eventually been necessary after the usual medical treatments gave only temporary relief of the condition

Operations are performed on the labyrinth, the VIIIth nerve, the autonomic nervous system and the cisterna pontocerebellaris

Operations on the VIIIth nerve belong to the domain of the neurosurgeon and shall not be discussed in detail in this paper It shall only be mentioned that complete section of the nerve relieves the vertigo but destroys the hearing It is in its effects not superior to destruction of the labyrinth but is a more extensive and hazardous procedure Differential section

According to Mygind and his school, not all the cases of Meniere's disease present the picture of endolymphatic hydrops. In many of them one must assume the presence of what he calls "endolymphatic compression" resulting from an overpressure in the perilymphatic system. This first stage might be followed by endolymphatic dilatation. Mygind quotes the histologically examined cases of Videbech and Arnvig as samples of Meniere's disease with endolymphatic compression. The case of Videbech, however, does not show the characteristic clinical picture of true Meniere's disease. It neither proves nor disproves Mygind's theories. The history in Arnvig's case is not detailed enough to establish beyond doubt the diagnosis of true Meniere's disease. If the endolymphatic dilatation is really the second stage of a process which begins with endolymphatic compression, it would be hard to understand why, in a patient with a clinical history dating back for 40 years and with repeated attacks of dizziness for the last 25 years, the histological changes should not have gone beyond the first stage.

As long as more convincing evidence to the contrary is not presented, one must regard endolymphatic hydrops as the anatomical basis of true Meniere's disease. It is, however, probable that in the early stages of the disease the endolymphatic system regains its original shape after the attacks. Later, the distension becomes permanent, although the endolymphatic pressure returns to normal. Mygind's opinion "that there is no borderline between Meniere's disease and, on one side, all the labyrinthine complications that may arise in connection with middle ear lesions and, on the other side, a number of endocranial affections with labyrinthine phenomena" is misleading and not confirmed by the histological findings in typical cases of Meniere's disease. The latter should rather be regarded as disease *sui generis* unrelated to other conditions with a more or less similar symptomatology.

Unless this sharp distinction is maintained, it is very difficult to evaluate the efficacy of treatments used in this condition A proper evaluation is, however, of the greatest importance, because it is obvious that surgical treatment should be considered only after medical treatment has proven ineffectual

Cases which clearly show the clinical picture of Menière's disease are not too frequent in my experience The very large series of cases supposedly observed by some authors within a relatively short period of time might be due to a less strict selection Another point which is easily forgotten is that the untreated cases of Menière's disease show a tendency to spontaneous remissions with return of the hearing to the previous level and, often, disappearance of the tinnitus within a few weeks, the remissions may last for many years The attacks of dizziness eventually become weaker spontaneously, no matter what treatment is used and finally disappear completely

Judging from my own experience and that of our department, I am unable to share the optimism of many authors concerning the chances for a permanently and completely successful medical treatment of fully developed cases of Menieres' disease except the rare bilateral cases where streptomycin achieves an incomplete or complete loss of function of the vestibular portions of both labyrinths In the great majority of cases of true Menière's disease followed in our department during the last years, surgical treatment has eventually been necessary after the usual medical treatments gave only temporary relief of the condition

Operations are performed on the labyrinth, the VIIIth nerve, the autonomic nervous system and the cisterna pontocerebellaris

Operations on the VIIIth nerve belong to the domain of the neurosurgeon and shall not be discussed in detail in this paper It shall only be mentioned that complete section of the nerve relieves the vertigo but destroys the hearing It is in its effects not superior to destruction of the labyrinth but is a more extensive and hazardous procedure Differential section of the vestibular portion attempts to preserve the hearing, but the results of the operation are often disappointing. In many instances the dizziness persists and the hearing becomes greatly reduced, due to the technical impossibility in many instances of cutting all the vestibular fibres and leaving the cochlear fibres intact. Section of the nerve, even in successful cases, does not influence the pathologic process in the inner ear, even if the vertigo is relieved, the hearing is bound to go down, due to the continuation of the attacks of endolymphatic hydrops.

The operations on the labyrinth consist of simple decompression of the perilymphatic space, complete or partial destruction of the membranous labyrinth or drainage of the endolymphatic space through incision of the endolymphatic sac.

The results of simple decompression of the perilymphatic space of the lateral semicircular canal (Jenkins, Hautant, Lindsay, 1919, and others) are unsatisfactory. In four cases of Lindsay, the opening in the bony wall of the canal stayed patent for more than a year. In three of them, a needle had been introduced through the window, and the nerve to the ampulla of the lateral canal had been destroyed. These patients were partially relieved from the dizzy spells. The hearing was reduced but not completely destroyed, the very unpleasant roaring noises persisted. Three of his patients showed a sensation of unsteadiness and nystagmus in the presence of loud noises, the so-called Tullio phenomenon.

A practically complete destruction of the labyrinth can be achieved through the classical methods of labyrinthectomy which might be combined with extraction of the stapes and the union of the round and oval windows into one large opening (Milligan, Lake, Yearsley, Matte, Jones, Botey, Hautant, Bourguet). Less extensive operations with a simple mastoidectomy as a preliminary step and closure of the retroauricular incision at the end of the operation attain the same results through opening of the vestibule from behind and destruction of its contents with a small dental excavator (Goodyear), or through exposure of the membranous lateral semicircular canal and excision of a small piece of it (Cawthorne) Contrary to our expectations, the latter procedure leads invariably to a complete loss of labyrinthine function This is difficult to understand because injury to the semicircular canal in the course of a fenestration operation frequently causes no further loss of hearing All the aforementioned authors use the retroauricular approach Lempert advocates an endaural transtympanic approach with preservation of the drum, extraction of the stapes, removal of the round window membrane and enlargement of the window itself All these operations eliminate the attacks of vertigo but completely destroy the hearing

Although the majority of cases unquestionably show unilateral involvement, estimates of the frequency of bilateral disease vary greatly According to Day, it is around 10 per cent, according to Wright, 28 per cent The latter reports that an additional 13 per cent of the originally unilateral cases later on showed an involvement of the other ear The findings in the limited number of histologically examined cases seem to be more in line with the higher figures given by Wright No matter what the final figures are, the possibility of a secondary involvement of the other apparently healthy ear must always be kept in mind This fact limits considerably the usefulness of destructive operations

The effect of the operations on the tinnitus varies Matte, who first tried to analyze the character of tinnitus in Menière's disease, found that the very annoying pounding and roaring noises disappeared after destruction of the labyrinth, whereas high-pitched, less unpleasant "seething" noise persisted, in the author's opinion, it probably originated in the nerve trunk. A similar differentiation between two kinds of tinnitus was more recently made by Day In 20 cases operated by Milligan the tinnitus was completely relieved in eight, partially relieved in four, and unchanged in eight

Lempert, without differentiating between the two kinds, believes the tinnitus to be most likely of cochlear origin. In his opinion, it disappears in those cases in which a complete and "atraumatic" degeneration of the cochlear part of the endolymphatic labyrinth, including the organ of Corti, takes place. Incomplete degeneration will not relieve the tinnitus. In case of degeneration as a result of postoperative infection, it will also continue, due to the cochlear neuritis caused by the extension of the inflammation from the organ of Corti to the cochlear nerve trunk. Lempert believes that such a complete atraumatic degeneration takes place in the manner he suggests. He reports disappearance of the vertigo in all 10 cases operated by him, with relief of the tinnitus in nine. Two cases in our department were recently operated after this method. In the first three months after the operation, the roaring noise was less intense but not relieved.

From the available material, it is impossible to draw any conclusions as to the possible seat of origin of the tinnitus and the causes for its disappearance or persistence. This is well illustrated by the fact that in a large series of cases in which labyrinthectomy had been performed for purulent labyrinthitis, tinnitus was strikingly rare, whereas in another series of cases in which healing had taken place without operation, tinnitus was often present (Schlander, Vienna, personal communication). On the other hand, tinnitus frequently persists after complete section of the VIIIth nerve, even though done under sterile precautions and without any evidence of postoperative infection.

Destruction of the labyrinthine contents has also been attempted by injection of dehydrated alcohol. This is done either through a hole in the lateral semicircular canal after opening of the mastoid (Mollison, Mill, McDowall) or through the stapes footplate into the vestibule (Wright, Peacock) or through the promontory into the basal cochlear turn (Berggren) without opening the mastoid. The impossibility of controlling the outflow of the injected alcohol from the labyrinth has in some instances caused facial paralysis. For this rea son this method seems less advisable than the open surgical approach

A selective destruction of the vestibular part of the labyrinth through electrocoagulation of the contents of a semicircular canal was first attempted by Putnam He made a small subtemporal decompression, elevated the dura as for the section of the trigeminal root, drilled a hole into the superior vertical canal and introduced a coagulation electrode into the lumen He was able to relieve the vertigo and to preserve the hearing The tinnitus remained unchanged and persisted even after secondary destruction of the cochlea

Day enters the mastoid through a retroauricular incision, exposes and opens the lateral semicircular canal, introduces a fine coagulating electrode through the opening into the vestibule and coagulates with a weak current His method has been widely accepted because of its relative simplicity and its good results A great number of operations has been reported without serious postoperative complications (Williams, Ireland, Lindsay and others)

Fifteen cases in our department were operated upon by this method Bone dust was put into the fistula after the coagulation in order to secure a bony closure Penicillin was given during the entire postoperative stay in the hospital, which averaged 10 days No serious postoperative complications attributable to infection occurred A transient facial paralysis in one case was evidently due to the use of too strong a coagulation current and too large a needle A similar observation was made in a case of McNally Like Day, we also found that the postoperative labyrinthine disturbances were much less severe than one would expect after sudden destruction of the labyrinth It is easy to understand that they were least marked in those patients who had had preoperatively a marked hypofunction of the labyrinth The results of the operation, as far as the elimination of the dizziness is concerned, are uniformly good The hearing is not invariably lost, as in the previously described operations, although it might decrease to a varying extent Among the 21 cases operated by Day, three retained usable hearing, in one of them, it improved from a 70 db loss to normal hearing, which was maintained for four years

In our 15 cases the vertigo was completely eliminated The hearing was completely lost in 11 Among the remaining four cases, it became worse in three The average additional postoperative hearing loss was 20 to 25 db in two cases, 35 db in another Postoperative improvement averaging 15 db was noted in one case In none of these cases did the postoperative hearing loss stay above the 30 db level In one of them, the loss for 512 was 30 db, for 1024 and 2048, 40 db, 11 months after operation

In a few of Day's cases, there was a transient postoperative improvement with eventual loss From these findings, Day believes that an open perforation must have existed in the membranous labyrinth which caused a gradual loss of endolymph and a consequent loss of hearing He also assumes that if the coagulating current could be so controlled as to seal off the perforation of the membranous organ made by the needle, the chances of preserving the hearing would be improved A slight withdrawal of the needle at the first application of the current, followed by a second or third application with the needle thus withdrawn, would seem to offer a better chance of sealing off the perforation of the membranous organ If the hearing loss is really due to damage to the organ of Corti in consequence of increased endolymphatic pressure, it would be difficult to understand how further endolymphatic pressure increases could be prevented after the perforation has been sealed off

The low-pitched roaring noise disappeared completely in 19 of the 21 cases reported by Day, in two of them it remained to a very slight extent A high-pitched tinnitus, however, remained and in some cases became even more pronounced Among our 15 cases, the ringing disappeared completely in four and remained unchanged in five In two cases it changed to a continuous high-pitched ringing, and in four cases there were occasional attacks of slight, high-pitched ringing In none of the cases was the postoperative tinnitus regarded by the patient as unbearable or even particularly annoying There was no definite relationship between the postoperative behavior of the noise and the hearing condition Among the cases in which the tinnitus completely disappeared, the hearing was either completely lost or, on the contrary, improved, in those cases in which it remained uninfluenced, the hearing was either decreased or completely lost Where the tinnitus became high-pitched postoperatively, the hearing was lost in all but one case where it only decreased

The analysis of our cases shows that complete relief from the dizziness and permanent as well as intermittent relief from the tinnitus is compatible with preservation of hearing

The greatest drawback of Day's method, as practiced today, is the impossibility of an exact control of the extent of the coagulation This explains the varying but usually unsatisfactory results obtained with this method with regard to the preservation of hearing

Animal experiments carried out on monkeys fail to clarify the situation Schall and Tom Rambo showed that with the use of an adequate coagulating current, the contents of the vestibule and the semicircular canals were destroyed and the cavities filled with fibrous tissue which shows a marked tendency to ossification Changes in the cochlea varied from absence of any damage to a serous and serofibrinous exudate filling both the scalae vestibuli and tympani There was, however, no definite relationship between the amount of damage to the cochlea and the time elapsed since the operation or the amount of the coagulating current used Slides demonstrated by Day of a human case with a long lasting postoperative hearing improvement which was maintained through several years showed the changes referable to the operation confined to the vestibule and the semicircular canals Experiments in monkeys carried out by Lindsay consisted in coagulation of the ampulla of the lateral canal, coagulation of all canals at maximum distance from the vestibule, injury to the nerves, to the horizontal canal ampulla and to the utricle, and use of very weak coagulating currents In no case did the injury result in any extensive change or fibrosis in the perilymphatic space of the vestibule The histologic findings failed to provide an explanation for the profound loss of hearing which occurred in humans in which the coagulation procedure had been limited to canals or their ampullae only

The unpredictable effects of the coagulation upon the hearing limit its usefulness again mainly to cases without usable hearing in the affected ear, otherwise, coagulation should be used in exceptional cases only As far as relief from vertigo and tinnitus is concerned, coagulation is as effective as completely destructive operations The operations attempting partial destruction, however, hold much greater potentialities for further progress It seems possible that eventually a method of intralabyrinthine surgery will be worked out which will preserve the hearing

A different and theoretically sound approach to the problem was devised by Portmann He believed that increased endolymphatic pressure was the cause of the Meniere attacks, an assumption which later was confirmed by the anatomical findings Using a retroauricular transmastoidal approach, he exposes the dura in Trautmann's triangle and exposes and incises the sac which lies between two layers of the dura By reducing the endolymphatic pressure, this operation is supposed to eliminate the attacks of dizziness and to restore as much as possible the original condition of the entire endolymphatic system In early cases the hearing is expected to improve, in those of longer duration, it is expected to remain at the preoperative level The cause for the attacks is not eliminated but as long as the opening in the endolymphatic sac remains patent, the endolymphatic pressure will increase very little, if at all, during the attacks and cause only slight if any, clinical manifestations

The operation does not entail any particular dangers. In cases of sclerotic mastoids and marked forward and lateral position of the sinus, injury to the latter and bleeding might occur, which, however, is easily controlled by packing. In case of bleeding, the operation should be stopped and finished a few days later. Whereas in the previously described operations the operative cavity is allowed to fill up with blood in order to secure the formation of dense scar tissue, great care must be taken in this operation that no blood accumulates in the cavity, because organization of the coagulum might lead to rapid closure of the opening in the endolymphatic sac. Sometimes it is difficult or even impossible to be sure that the sac is actually opened. In these cases it is suggested by Woodman to lift the dura from the posterior surface of the petrous bone towards the internal auditory meatus. In this way, the endolymphatic sac is torn at the place where it leaves the bone and enters the dura.

Although the idea of the operation is theoretically sound, it has a very serious drawback in the inability to secure the permanent patency of the opening in the sac. The results obtained by me in eight cases are far less favorable than those reported by Woodman and by Waltner. Woodman, for instances, reported that among 11 operated cases the vertigo was cured in eight and relieved in one. The tinnitus was cured in two and improved in one. The hearing was improved in six and unchanged in two. Waltner reviewed Portmann's cases and found that the vertigo was always cured, the tinnitus improved in most of the cases and the hearing improved in many of them. The results obtained by other authors were less favorable. Parkinson found in one case, two years postoperative, that the vertigo was reduced to occasional mild feeling of unsteadiness for about one hour's duration. There was a decrease of the tinnitus, but a progressive loss of hearing. Cawthorne got unsatisfactory results in several cases. According to Harrison, the immediate results of the operation are excellent, later, a fibrosis around the saccus develops and the patient returns to his previous state or a gradual loss of function results which renders the operation pointless.

Among the eight cases operated by me, two have remained completely free from attacks, one so far for three years and one for 16 months.* In the former the hearing improved postoperatively, in the latter the hearing became slightly worse, the ringing decreased in intensity but did not disappear completely. In the third case the attacks disappeared for one year but came back, evidently due to involvement of the other ear. In the fourth case there were no attacks in the three months elapsed since the operation. In the fifth case the attacks started to recur after nine months and a coagulation of the labyrinth was performed. The other three cases were outright failures. In one of these a postoperative hemorrhage into the mastoid cavity had caused a rapid obliteration of the lumen of the sac and a coagulation of the labyrinth was successfully performed, in the two other cases the cause for failure was not so obvious. In one of these a complete section of the VIIIth nerve was done and the vertigo disappeared. The other patient, treated with streptomycin, showed improvement but not complete disappearance of the vertigo. This case, however, is difficult to evaluate, due to the presence of a marked psychoneurotic factor. The hearing was improved in two cases, unchanged in two, slightly worse in another two, and markedly so in still another two cases. The tinnitus disappeared completely in the two cases in which the hearing has improved, remained unchanged in two, and became reduced in intensity in the four others.

The results with Portmann's operation in this series are obviously not impressive, nevertheless, it seems worthwhile to try the operation in all cases with serviceable hearing in the affected ear, particularly when the hearing in the other ear is not normal. All our patients are informed about the limited chances of success from the operation and the reasons why it, nevertheless, should be tried. It is explained to them that if the intervention is unsuccessful, a coagulation of the diseased labyrinth could be done as a short second operation.

---

*Meanwhile the first of the two cases had to undergo a coagulation of the labyrinth.

Anatomical specimens of operated cases are unfortunately not yet available The limited number of cases in which Portmann's operation brought unquestionable permanent relief from vertigo contradict Lindsay's statement that drainage could have only a limited influence on labyrinthine hydrops and that any effect of the operation could be of only relatively brief duration Lindsay comes to his conclusions from the results of experiments on monkeys He found there that simple drainage and various degrees of destruction of the saccus as well as destruction of nearly all of the endolymphatic duct were followed by prompt healing and filling out of the defect with newly formed bone The remainder of the endolymphatic system and the sensory organs showed no histological variation from the normal Ohma, however, in one case of a human with obliteration of the endolymphatic duct, found dilatation of the cochlear duct, the saccule and the utricle The possibility should also be considered that in the presence of hydrops the chances for permanent patency might be better than in a normal endolymphatic system

Operative interventions on the autonomic nervous system in Meniere's disease are performed on the assumption that labyrinthine hydrops might be the result of neurovascular and possibly neurosecretory changes in the labyrinth (see Hilger) The influence of the autonomic nervous system upon the labyrinth can be seen from the results of animal experiments and operations on humans Constriction of the labyrinthine blood vessels causes an increase in the excitability of the vestibular portion, dilatation of the blood vessels leads to a diminution in the excitability of the vestibular portion and an increase in the hearing acuity (see Frazer) The operations which have so far been undertaken in Ménière's disease attempt to secure the inhibition of the vasoconstrictor impulses to the inner ear in order to secure a more stable flow of blood Elimination of spasms of the labyrinthine vessels is supposed to prevent the development of the hydrops and in this way to eliminate further attacks The interventions include decortication of the common carotids, excision of the cervical sympathetic trunk and of the superior, middle and inferior cervical sympathetic ganglia, and various combinations of these procedures The immediate results of these operations have been good, but in the majority of cases the symptoms have gradually returned within a few weeks or months, particularly in cases in which operations on the carotid arteries alone were performed This becomes understandable in the light of Frazer's experiments in cats where the internal ear can be completely deprived of its vasoconstrictor impulses by cutting the cervical sympathetic trunk but not by decortication of the carotid arteries Removal of the stellate ganglion or operations on the vertebral arteries are unnecessary in cats as long as the sympathetic trunk is interrupted above the ganglion

Good results were lately reported after cervical ganglionectomy by Biancalana and by Mogan and Baumgartner In the observation of the latter two authors there was no recurrence of the vertigo, no further deterioration of hearing and only occasionally slight tinnitus

Garnett Passe and Seymour have recently reported a series of 12 cases of Meniere's disease in which the stellate ganglion was removed In four of them, in addition to the stellectomy, the vertebral artery was either ligated or divided, in two cases it was decorticated In 11 cases the vertigo attributable to the operated ear was completely relieved Tinnitus was completely relieved in three cases and reduced in most of the others The relief seemed more pronounced with the pulsating type of tinnitus than with the continuous variety The perceptive type of deafness from which each patient had suffered showed improvement in most of the cases, with the exception of those in which the deafness was already very far progressed and beyond relief Horner's syndrome was present after the operation According to the authors, it rarely troubled the patients after the first few days and tended to correct itself within a few months The diagnosis of true Meniere's disease was not established beyond doubt in all the cases and the time of postoperative follow-up was very short in many of them In some cases the symptoms could have been due to vascular (arteriorsclerotic) changes and elimination of vasoconstrictor impulses should have had a particular beneficial effect The results in the cases with intervention on the vertebral artery were not better than in those without intervention The assumption that constriction of the labyrinthine vessels plays an essential part in bringing about the Menière attacks needs confirmation through further clinical and experimental research before it can be unreservedly accepted, but even now, interventions on the cervical sympathetic system should be regarded as a promising rational treatment not only of Menière's disease but also of other inner ear conditions, particularly deafness of the perceptive type

Drainage of the pontocerebellar cisterna is helpful in cases of Bárány's syndrome, which is supposed to be caused by increased tension within the cisterna Bárány's syndrome, however, is not related to true Ménière's disease, in spite of a somewhat similar symptomatology If interventions on the lateral cisterna are mentioned by some authors among the treatments for Menière's disease, it shows again only the confusion which still exists with regard to the meaning of the term "Ménière's disease" and the necessity for a clear-cut definition of it

SUMMARY AND CONCLUSIONS

The term "Menière's disease" should be confined strictly to cases which show all the classical signs and symptoms of the condition It should not be applied to even slightly questionable cases, because this would confuse the issue and constitute a great danger for the proper evaluation of the results of any kind of treatment

Meniere's disease or endolymphatic hydrops is a relatively rare disease with a known pathology but, so far, unknown etiology It seems to be a disease *sui generis* and not related to other conditions with a similar symptomatology

Contrary to the experience of other authors, we have found that fully developed cases of Meniere's disease can very rarely be permanently cured by conservative measures and that ultimately surgery or streptomycin therapy must be considered in most of them. This discrepancy is probably due to the very rigid standards used in our department for the selection of the cases and our insistence upon a follow-up over a prolonged period of time before we regard a case as cured.

For a proper evaluation of the results, one should distinguish between two groups of cases: those in which the vertiginous attacks have completely disappeared and those in which they have persisted. To create a special group of "improved cases" seems of questionable value because one has to rely too much upon the patient's evaluation of the severity.

In the evaluation of the tinnitus, special attention should be given to the character of the tinnitus and possible changes brought about by the operation. Differences in the intensity seem of lesser importance.

In spite of our great skepticism regarding the chances for success of the medical treatment, it should be given a fair trial in each case before surgery is considered.

Among the various kinds of surgical treatment, interventions on the autonomic nervous system seem promising, but have not yet progressed beyond the very first experimental stages.

Endocranial surgery achieves good and reliable results for the relief of vertigo in cases in which the nerve is completely cut, the hearing is completely lost and the tinnitus not seldom persisting. The same results are, however, achieved with less extensive and less hazardous operations on the labyrinth. The results of differential section of the vestibular nerve are sometimes gratifying but as a rule out of proportion with the magnitude of the intervention. It seems, therefore, that at the present time operations on the labyrinth are a more rational way of surgical treatment of Meniere's disease

Operations on the labyrinth can be divided into two groups The first group tries to achieve either complete destruction of the labyrinth or localized destruction of the vestibular portion with preservation of the cochlear part, operations of the second group attempt drainage of the endolymphatic system with subsequent reduction of the endolymphatic pressure

The completely destructive operations eliminate the dizziness together with all residual hearing, but their effect upon the tinnitus is less certain Time alone will tell whether certain types of destructive operations are more successful in this respect than others The usefulness of these operations is confined to cases with unilateral involvement and, perhaps with rare exceptions, to cases without usable hearing in the affected ear To sacrifice hearing in the involved ear appears risky in view of a possible future affection of the other ear For the same reason, operations in cases with bilateral involvement must be regarded as too dangerous even if the symptoms point definitely to the more affected ear as the source of the actual troubles

Operations aiming at selective destruction of the vestibular portion have been equally successful in the elimination of the vertiginous attacks Although the hearing might be preserved or even improved in a small number of instances, it is impossible to tell beforehand when this will occur For this reason, the indications for these operations remain essentially the same as for the completely destructive procedures Coagulation of the membranous labyrinth, according to Day, is the most widely accepted procedure and has given satisfactory results in the 15 cases operated in our department

The indications for drainage of the endolymphatic system (Portmann, Woodman) are much wider and comprise all the cases of Menière's disease, including those with usable hearing Judging from our experience with eight cases, the operations are successful in only a very limited number , nevertheless, the operation should be tried in cases where preservation of the residual hearing in the affected ear is essential. In case of failure, it can be followed by coagulation of the labyrinth.

At the present time, it cannot be foreseen whether the technique of intralabyrinthine surgery will *eventually* be so far improved as to achieve an isolated destruction of the vestibular portion in all cases. If not, the possibility still remains that operations on the autonomic nervous system will be the ultimate answer to the challenging problem.

BIBLIOGRAPHY

BÁRÁNY, R: Der Baranysche Symptomenkomplex, seine Diagnose und Therapie, Ätiologie und Prognose. *Verhandl. dtsch. otol. Ges.*, 21: 108, 1912.

BERGGREN, E: Contribution Toward the Surgical Treatment of Morbus Ménière. *Acta Oto-Laryngol.*, 27: 626, 1939.

BERGGREN, S: Die Bedeutung von Golls und Burdachs Kernen bei Ménièreschen Anfällen. *Acta Oto-Laryngol.*, 15: 234, 1931.

BIANCALANA, L: La stellectomia per la cura delle sindromi di Ménière postototiche. *Ann. di laryngol.*, 39: 11, 1939.

BOTEY, R: Die Trepanation des Labyrinthes bei Schwindel und Ohrensausen. *Monatsschr. f. Ohrenh.*, 18: 265, 1914.

BOURGUET, J: Traitement chirurgical des vertiges labyrinthiques par l'evidement des canaux semicirculaires. Méthode et technique personnel. *Bull. et Mém. Soc. de Chir. de Paris*, 22: 175, 1930.

CAWTHORNE, T: The Treatment of Ménière's Disease. *Jour. Laryngol. and Otol.*, 58: 363, 1943.

CHEATLE, A H: Quoted after I. C. Jones.

DAY, K M: Labyrinth Surgery for Ménière's Disease. THE LARYNGOSCOPE, 53: 617, 1943.

DAY, K M: Hydrops of Labyrinth (Ménière's Disease): Diagnosis, Results of Labyrinth Surgery. THE LARYNGOSCOPE, 56: 33, 1946.

DAY, K M: Discussion to Lindsay. *Trans. Amer. Acad. Ophthal. and Otolaryngol.*, 53: 531, 1948-1949.

FRAZER, P J: Vasomotor Control of the Ear. *Jour. Laryngol. and Otol.*, 51: 579, 1936.

GOODYEAR, H M: Ménière's Disease: Surgical Approach to the Labyrinth with Destruction of the Utricle, Case Reports. THE LARYNGOSCOPE, 53: 713, 1943.

Harrison, M S Ménière's Disease *St Thomas Hosp Gaz* 43 88 1945

Hautant, A. Traitement chirurgical du vertige auriculaire *Ann d mal d l'oreille et d larynx*, 45 924, 1926

Hilger, J A. Autonomic Dysfunction in the Inner Ear The Laryngoscope, 59 1 1949

Ireland, P E The Diagnosis and Treatment of Ménière's Symptom Complex. *Canad Med Assn Jour*, 58 269 1948

Jenkins, G J Labyrinthine Vertigo (Ménière's Symptoms — Non infective) Treated by Operation *Proc Roy Soc Med*, 4 116 1911

Jones, H E The Operative Treatment of Aural Vertigo Due to Causes Other Than Suppuration *Liverpool Med Chir Jour*, 32 445 1912

Knapp, H A Clinical Analysis of the Inflammatory Affections of the Inner Ear *Arch Ophthal*, 2 204 1871

Lake, R Removal of the Semicircular Canals in a Case of Unilateral Aural Vertigo *Lancet*, 1 1567, 1904

Lake, R A Case of Operation on the Vestibule for the Relief of Vertigo *Lancet*, 1 26 1906

Lake R. Ten Cases of Operation for Ménière's Disease (Aural Vertigo) *Lancet*, 1 1569 1911

Lake, R Aural Vertigo (Nonsuppurative) A Clinical and Therapeutical Study *Lancet*, 2 1638 1912

Lempert, J Lempert Decompression Operation for Hydrops of the Endolymphatic Labyrinth in Ménière's Disease *Arch Otolaryngol* 47 551 1948

Lindsay, J R Healing of Experimental Labyrinthine Fistulas Further Observation *Arch Otolaryngol*, 46 584 1947

Lindsay, J R Effect of Obliteration of the Endolymphatic Sac and Duct in the Monkey *Arch Otolaryngol* 45 1 1947

Lindsay J R Labyrinthine Surgery for Ménière's Disease The Laryngoscope, 59 22 1949

Matte Zur Chirurgie des Ohrlabyrinthes *Arch f Ohrenh* 73 142 1907

Matte Labyrinth Operation wegen hochgradigsten Labyrinthschwindels *Arch f Ohrenh* 86 243 1911

McDowall G D Surgery of Ménière's Disease *Jour Laryngol and Otol* 62 420 1948

McNally W J Quoted after Lindsay 1949

Mill, W A. The Operative Treatment of Ménière's Syndrome *St Thom Hosp Rep* 1 192 1936

Milligan W Ménière's Disease A Clinical and Experimental Inquiry *Brit Med Jour* 2 1228 1904

MILLIGAN, W The Surgical Treatment of Suppurative and Certain Nonsuppurative Affections of the Labyrinth *Jour Laryngol and Otol* 39 215, 1924

MOGAN, R F, and BAUMGARTNER, C J Ménière's Disease *Arch Otolaryngol*, 41 113, 1945

MOLLISON W M Operative Treatment of Vertigo *Proc Roy Soc Med*, 28 1597, 1935

MYGIND, S H Histologic Studies of the Labyrinth XI—Correlation of Our Histological and Clinical Experiments and Observations *Acta Otolaryngol*, 35 108, 1947

MYGIND, S H Further Labyrinthine Studies *Acta Oto Laryngol* Supp 68, 1948

OHMA M Uber einige Beziehungen krankhafter Veränderungen der Labyrinthliquor Räume und Liquorkanäle zueinander *Hals usw Arzt*, 30 73, 1939

PARKINSON, S N Ménière's Symptom Complex, Endolymph Decompression with Symptomatic Improvement, Report of a Case *Ann Otol, Rhinol and Laryngol*, 44 382, 1935

PASSE, E R G, and SEYMOUR, J S Surgical Treatment of Ménière's Disease *Brit Med Jour*, 1 812, 1948

PEACOCK, R Ménière's Syndrome *Lancet*, 2 1109, 1938

PORTMANN, G The Saccus Endolymphaticus and an Operation for Draining the Same for the Relief of Vertigo *Jour Laryngol* 42 809 1927

PUTNAM T J Treatment of Recurrent Vertigo by Subtemporal Destruction of the Labyrinth *Arch Otolaryngol*, 27 161, 1938

ROYLE N D Alteration of the Circulation of the Brain by Surgical Means in Diseases of the Central Nervous System *Brit Med Jour* 1 1063, 1932

SCHMITT L A, and TOM RAMBO, J H Electrocoagulation of the Membranous Labyrinth Experimental Studies in the Monkey *Ann Otol Rhinol and Laryngol* 57 590 1948

TERRACOL J Nystagmus et sympathique cervical Recherches Experimentales *Ann mal d l'oreille d larynx d nez et d pharynx* 46 1125 1927

UFFENORDE, W Die chirurgischen Erkrankungen des innern Ohres *Hand d spez Chir d Ohres u d ob Luftwege* hrsg v L Katz und F Blumenfeld, 2 657, C Kabitzsch, Leipzig 1925

VIMBECK H Alteration du labyrinthe se presentant sous les traits du syndrome de Ménière *Acta Otolaryngol* 22 51 1935

WALTNER, J Le blocage du sac endolymphatique et l'operation de Portmann *Rev d Laryngol*, 61 1 1940

WILLIAMS H L The Present Status of the Diagnosis and Treatment of Endolymphatic Hydrops (Ménière's Disease) *Ann Otol Rhinol and Laryngol* 56 614 1947

Woodman, E M. The Position of the Portmann Operation in Relation to Vertigo *Proc Roy Soc Med*, 32 1642, 1939

Wright, A. J Aural Vertigo A Clinical Study *Proc Roy Soc Med*, 31 87,1937

Wright, A J Labyrinthine Destruction in the Treatment of Vertigo by Injection of Alcohol Through the Oval window *Jour Laryngol and Otol*, 53 594, 1938

Wright, A. J The Deafness of Ménière's Disease *Jour Laryngol and Otol*, 58 379, 1943

Yearsley, M A Case of Severe Vertigo Destruction of the Labyrinth, Cure *Lancet*, 2 871 1908

Yearsley, M. Treatment of Labyrinthine Vertigo by Operation *Clin Jour* 63 383, 1934

II PANAMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY

The second PanAmerican Congress of Otorhinolaryngology and Bronchoesophagology will be held in Montevideo-Buenos Aires, Jan 8 to 15, 1950 For further information communicate with Dr Chevalier L Jackson, 3401 North Broad Street, Philadelphia 40, Pa

THE USE OF THROMBIN AND ABSORBABLE SPONGE FOR HEMOSTASIS IN OTOLARYNGOLOGY *

B H SENTURIA M D , J H OGURA, M D , and
T E WALSH, M D ,†
St Louis, Mo

In a previous study, the anatomy, histopathology, incidence, causes, and methods of control of nasal hemorrhage in a series of hospitalized cases were discussed[1] The techniques and substances which were tried and discarded in the search for satisfactory methods of hemostasis were outlined In the course of this study an opportunity was afforded to evaluate the efficacy of thrombin and absorbable sponge in the ear, nose, and throat

A number of excellent reviews on the development of hemostatic agents have appeared Great advances have been made in neurosurgery with the early use of electro-cautery, muscle implant, and the silver clip[2] Later thrombin[3,4] and fibrin foam[5] were successfully isolated for control of capillary and venous bleeding More recently the use of absorbable sponge,[6] absorbable cotton,[7] casein fibrin,[8] and starch sponge[9] have been suggested for surgical hemostasis

There are some limitations to the usual techniques for the control of bleeding in various otolaryngologic procedures During mastoid surgery it is undesirable to use coagulation current on the dura, on the lateral sinus, around the facial nerve, or in the middle ear When performing operations on

---

*This study made possible by a grant from the Upjohn Company, Kalamazoo Mich Absorbable sponge is marketed under the commercial name of Gelfoam

†From the Department of Otolaryngology, Washington University School of Medicine St Louis Mo

Editor's Note This ms received in Laryngoscope Office and accepted for publication July 11 194[illegible] the nasal septum and sinuses, ligation of bleeding points is not usually possible, and cautery for the control of bleeding may not be practical

Because the subject has been widely discussed, little need be said here about thrombin except that its discovery and development was a most important step in the problem of hemostasis Seegars *et al*[10] successfully used thrombin from beef plasma Its low toxicity when applied locally was noteworthy It has been shown by Tidrick *et al*[11] that the use of thrombin provides an excellent surgical adjunct in the control of oozing from capillaries and small venules

A water insoluble gelatin base sponge was prepared by Correl, Prentice, and Wise[9] which when implanted in tissues was almost entirely absorbed in thirty days with little tendency to encapsulate Slight tissue reaction occurred and there was only moderate cellular infiltration These investigators demonstrated that gelatin sponge implants become more gelatinous and transparent with time. Only a small film could be found on the twentieth day Histologic identification of any unabsorbed material was doubtful after the twenty-fifth day Slight cellular infiltration was noted maximally between ten to twenty-five days and then seemed to recede.

Gelatin sponge has been demonstrated to be a pliable substance when moistened and capable of absorbing many times its own weight of fluid, thus acting as an excellent carrier[12] It has been shown to be non-antigenic and non-pyrogenic. It does not inactivate penicillin and can be readily used with thrombin without prior neutralization[13] Jenkins and Clarke[14] reported that gelatin sponge had hemostatic properties of its own and used it as a supplement to ligature or where ligature was inappropriate

Pilcher and Meacham[15] found that gelatin sponge was useful in the control of epidural venous bleeding, particularly under a bone edge, in diffuse tumor bed oozing, and in preparation of a dry bed for a sutured peripheral nerve A survey by these authors of the results obtained by various neurosurgeons revealed that the sponge was "satisfactory in the majority of cases."

Light and Prentice[16] emphasized the use of the sponge for the repair of torn venous sinuses and control of dural ooze. They suggested that small vessel bleeding in structures likely to be injured by a clip or cautery could readily be controlled by gelatin sponge. It was recommended as a seal for spinal fluid leaks, or to bridge a defect in the dura. A tendency for the absorbable sponge to adhere to dura and not to brain was noted. In another report, Light and Prentice[17] used absorbable sponge with thrombin as a "patch" for repairing venous sinuses. These authors reported that the lumen of the sinus was left patent without the formation of a thrombus within the vein. The method was inappropriate for arterial hemostasis.

Some contraindications to the use of absorbable sponge have appeared. Jenkins *et al.*,[18] for example, advised against its use in donor areas (skin graft) as liquefaction of the sponge interfered with after care.

METHODS AND TECHNIQUES

Thrombin. Bovine thrombin is provided as a sterile water soluble white powder which remains stable in the dry state. In solution it retains its potency for about eight hours at room temperature. During this study, thrombin was supplied in vials containing 1000 units* and was diluted with sterile normal saline to various concentrations. In solution it was sprayed or used in the form of drops. In initial experiments as little as 100 u/cc were used, and in others as much as 1000 u/cc. The solution was impregnated in cotton pledget and wicks, gauze, or absorbable sponge.

In the process of coagulation, thrombin comes into contact with blood from a veno-capillary bed and initiates thrombosis by converting fibrinogen to fibrin. This produces a clot on the surface of the smaller vessels, but does not extend into the vessel.[19] As also suggested by Tidrick,[20] if much blood is present in the field, thrombin clots the surface blood and bleeding goes on under the clot If the surface clot is wiped away, the "anchorage" is removed and bleeding may resume

---

*One unit is that amount which will cause one cubic centimeter of standardized fibrinogen solution to clot in fifteen seconds.

In this study, thrombin was painted over the medial surfaces of the septal flaps following submucous resection after the techniques described by Fox[21] and Reading,[22] was applied to the tonsillectomized fossae and to the nasopharynx after removal of adenoids and was packed into the mastoid or middle ear cavity following surgical exenteration of diseased bone. A cotton pledget soaked with thrombin was applied to the middle ear just prior to skin grafting

Absorbable Gelatin Sponge Absorbable gelatin sponge may be used in the dry state or saturated with saline, thrombin, or penicillin without prior neutralization The dry sponge was trimmed to the desired size and thickness and shaped with a scissors using enough to cover the bleeding area or the defect. It was usually prepared for hemostasis by soaking in the desired solution and kneading forcefully until the air was completely expelled from the interstices At this point the sponge was very limp and decreased in size It was reinserted into the solution and allowed to swell to its original size and shape Just prior to its application it is desirable to squeeze out the excess thrombin with a gauze sponge so that when it is applied over a bleeding point, blood is absorbed into its meshes where clotting occurs and the desired "anchorage" obtained Where possible, it is advantageous to apply a cotton pledget over the absorbable sponge before applying suction in order to get blood into the interstices of the sponge. As emphasized by Light and Prentice[1, 17] blood must flow into the sponge if good hemostasis is to be obtained

When used in the ear, nose, and neck, absorbable gelatin sponge was saturated with thrombin containing 100-1000 u cc When the facial nerve was exposed or injured, during radical mastoidectomy, a longitudinal piece of absorbable sponge saturated in thrombin (500 u/cc) was placed over the nerve prior to skin grafting

RESULTS

THROMBIN

A Ear During eighty radical mastoidectomies, thrombin (100-750 u/cc) was applied to bleeders from bone, soft tissue, and dura where epinephrine alone was tried and was not found to be effective consistently Persistent bleeding over the posterior canal wall and facial nerve region was controlled frequently with thrombin After radical mastoidectomy where primary skin grafts were done, cotton saturated with thrombin was packed into the middle ear and allowed to remain in place for ten minutes This procedure has been found to leave a clean dry bed onto which a skin graft could be placed with excellent results In some instances of active bone bleeding good hemostasis was not obtained with thrombin or epinephrine and a polishing burr was required

B Throat Fifty tonsillectomies were performed by dissection and snare or Sluder techniques under ether anesthesia All arterial bleeding and severe venous bleeding were controlled by ligatures Thrombin (200 u/cc) on a cotton or gauze sponge was applied to one tonsillar fossa, and a dry sponge to the contra-lateral fossa Satisfactory results were obtained in veno-capillary oozing with thrombin, but the dry sponge held in the control fossa also stopped veno-capillary oozing in the majority of the cases Thrombin did not control heavy venous or arterial bleeding from the upper pole

Post-operative bleeding occurred from a tonsillar fossa during the first 24 hours in one case where thrombin was applied to that fossa In three instances delayed bleeding occurred without explanation from a tonsillar fossa on the 7-10th post-operative day

C Nasopharynx Under ether anesthesia fifty adenoidectomies were performed using the La Force adenotome and curette Thrombin on a gauze sponge (200-500 u/cc) was held against the visible bleeding adenoid bed Active bleeding from the lateral wall of the nasopharynx was not controlled by thrombin When capillary oozing occurred from the cut nasopharyngeal epithelium or the adenoid bed, very prompt control of bleeding was obtained In twenty-five routine cases, a one-inch post-nasal gauze pack saturated with thrombin (200 u/cc) was packed into the nasopharynx for 5-10 minutes immediately following adenoidectomy The results were not superior to dry gauze packing

D Nose In fifteen cases of epistaxis from Little's area and from the lateral nasal wall, thrombin solution (100-500 u/cc) was applied to the affected surface by spray or on a cotton pledget In four cases prompt cessation of bleeding occurred, of these, three recurred in a short interval Control of the bleeding was not obtained in the remaining cases

Following six submucous resections, the medial surfaces of the septal flaps were painted and then the area flooded with thrombin (200 u/cc) The septal flaps were then firmly packed together with vaseline gauze packs for twenty-four hours The application of thrombin in this surgical procedure may have contributed to a decrease in post-operative oozing and better adhesion of the flaps

ABSORBABLE SPONGE WITH THROMBIN

A Ear

Thirty radical endaural mastoidectomies were performed in which the Eustachian tube was cleaned out thoroughly Absorbable sponge saturated in thrombin was packed into the common lumen of the Eustachian tube and canal of the tensor tympani muscle for the purpose of sealing off this lumen This provided a good bed for a skin graft In a few cases the absorbable sponge did not adhere satisfactorily in the Eustachian tube As a result, the Eustachian tube lumen did not remain obliterated long enongh for the skin graft to "take."

In five radical mastoidectomies, unusually large cavities were produced in removing the diseased bone completely It was considered desirable to reduce the size of the cavity in order to facilitate healing and post-operative care These recesses were packed with absorbable sponge containing thrombin and were skin grafted primarily or secondarily (five days) Excellent healing occurred In another three cases, cells were removed posterior to the solid angle producing a large deep defect in the direction of the petrous apex These tracts were filled with absorbable sponge and thrombin and skin grafted Rapid healing took place

Following the preparation of the membranous flap in the fenestration operation, a linear tear was obtained close to the tympanic membrane in four cases After the flap was placed in position, a thin sheet of absorbable sponge was applied over the laceration and then covered with batiste gauze and the cavity packed in the usual manner After the packing was taken out, the remaining sponge was easily removed by point suction, leaving the healed flap intact and in place

In two cases where persistent and uncontrollable bleeding occurred from small vessels over the lateral sinus and dura, a small thin strip of absorbable sponge saturated with thrombin was applied to the bleeding point with control of the bleeding

In nine cases where the facial nerve was found exposed by cholesteatoma, or where decompression was performed following operative injury to the nerve, a longitudinal piece of absorbable sponge containing thrombin was laid over the nerve to control bleeding and to act as a protective cushion for the skin graft to follow There was no evidence in any of these cases which suggested interference with facial nerve function by absorbable gauze

In one case where the dura in the area of the tegmen mastoidea was perforated with a burr during mastoidectomy, the dural perforation was sealed with absorbable sponge and thrombin Excellent control of the spinal fluid ooze was obtained so that the operation could be completed and no immediate or late postoperative complications arose In two cases where infected bone was removed from the hypotympanum over the jugular bulb, profuse bleeding was encountered Absorbable sponge saturated with thrombin was applied over the area and a pressure gauze packing placed on top of the absorbable sponge Bleeding was controlled promptly Gauze packing was removed on the fifth day without recurrence of bleeding and the area skin grafted uneventfully

In one case of lateral sinus thrombosis,[*] following incision of the vessel wall and removal of the occluding thrombus, the proximal and distal portions of the vessel were packed off, and the site of incision was patched with absorbable sponge and thrombin and then packed with iodoform gauze The packs were removed on the tenth day without recurrence of bleeding In another case where needle aspiration of the exposed lateral sinus was performed in order to exclude an obliterating thrombus, brisk bleeding was readily controlled with absorbable sponge saturated with thrombin applied over the opening

B Nose

Absorbable sponge with thrombin was used as an effective hemostatic adjunct in six out of seven cases where radical sinus surgery was performed

1 A radical bilateral Killian operation was performed for osteomyelitis of the frontal bone In exenterating the ethmoid sinuses a laceration of the dura was produced Three pieces of absorbable sponge saturated with thrombin were placed over this opening There was immediate cessation of spinal fluid flow and there were no post-operative complications while observed over a period of one year

2 An exploratory external ethmoidectomy was performed for recurrent meningitis developing after a fracture through the ethmoidal labyrinth A large dehiscence with surrounding soft bone was found extending through the ethmoid capsule into the anterior cranial fossa During the removal of the involved bone a cerebrospinal leak occurred Absorbable sponge saturated with thrombin was applied over the defect with immediate cessation of drainage The patient has been observed for five weeks without complications

---

[*] Case of Dr A M Alden

3 and 4 Two external frontal operations (modified Killian)* were performed in cases of frontal empyema with secondary frontal lobe brain abscess In both cases following the completion of the radical frontal sinus procedure, there was encountered a fistula into the frontal lobe from which pus exuded After evacuation from the abscess cavity, absorbable sponge and thrombin were applied as a patch The postoperative courses were entirely uneventful

5 An external frontal operation (Killian)* was performed for osteomyelitis of the anterior table of the frontal sinus After the completion of the sinus surgery, the superior and external angles of the sinus were obliterated with absorbable sponge and a gauze drain inserted into the medial angle of the wound A fresh gauze drain saturated with penicillin was inserted daily until complete and satisfactory obliteration occurred

6 A transantral ethmoidectomy was performed for an orbital decompression in a case of exophthalmos A spinal fluid leak occurred in the region of the cribriform plate Absorbable sponge and thrombin were placed up against the roof of the cavity Spinal fluid continued to leak intermittently for ten days Unsatisfactory sealing of this case was due in part to the inaccessibility of the lesion

7 A radical Killian was done for empyema of the frontal sinus and a large defect found in the posterior plate An area of granulation was present on the dura, in the center of which a small pinpoint defect was noted The cerebrospinal leak was sealed with absorbable sponge containing 200 u thrombin and 25,000 u penicillin The dead space produced by the extensive removal of bone was obliterated with absorbable sponge and thrombin The results here appeared good six months after operation

---

*Cases of Dr M F Arbuckle

In one case where contiguous perforations of both mucous membrane flaps were obtained following submucous resection of the nasal septum, a thin dry flat sheet of absorbable sponge was inserted between the membranes so as to obliterate the defect and prevent "turning in" of the edges Excellent healing followed and no unusual residual thickening resulted After one month no perforation had appeared In a similar case* where a cartilage implant was to be used, it was possible to suture one side, insert the cartilage and then over this the sheet of dry sponge The cartilage was not extruded, and good healing occurred

In two cases where biopsies were taken from Little's area (varicosity and neuroma), large excisions of mucous membrane were required Persistent oozing was controlled by absorbable sponge and thrombin with an overlying pressure gauze pack. After several days the absorbable sponge was easily blown out of the nose without recurrence of bleeding The sponge acted as a protective covering so that removal of the gauze packing did not cause further bleeding

In ten cases of epistaxis, absorbable sponge and thrombin were used Bleeding occurred from the inferior, middle, and superior meatuses and from Little's area It was found difficult to apply the sponge in those cases where bleeding arose from the lateral nasal wall, particularly when the bleeding site was posterior Good results were obtained in one case involving Little's area and the two instances from the inferior meatus

C *Throat and Nasopharynx*

It was not considered advisable to use absorbable sponge following tonsillectomy and adenoidectomy since no method could be devised which insured against the danger of aspiration of the sponge

D *Neck*

Absorbable sponge and thrombin were used during four radical dissections where bleeding could not be satisfactorily controlled with ligatures These cases received pre-operative X-ray therapy which undoubtedly contributed to the difficulty of hemostasis Prompt control of bleeding was obtained in all cases and no satisfactory post-operative sequelae occurred

---

*Case of Dr Guerdan Hardy

DISCUSSION

In this study no attempt was made to compare the several biological hemostatics now available The relative merits and applicability of these agents will form the basis of a future report

The mechanism of the action of thrombin has been widely discussed[10] It is said to exert its effect by clotting the surface blood which extends over the openings of the vessels forming an "anchorage clot" and must not be disturbed or bleeding will recur This is in contrast to epinephrine which exerts its effect by vasoconstriction When the constrictive action of the epinephrine wears off, there is slow vasodilation If clotting is not adequate, bleeding will recur In other words, epinephrine produces its effect by constricting the vessel and thrombin by forming a clot over the opening in the vessel wall

Epinephrine is desirable for effective temporary hemostasis while cleaning out thickened diseased membrane in the middle ear A cotton tipped applicator soaked in epinephrine is of value in removing granulations from the horizontal semicircular canal and for sweeping infected mucous membrane into the middle ear in order to identify the facial nerve It is clear that the formation of a surface blood clot by the use of thrombin would not be of value in this instance

After cleaning out the middle ear and Eustachian tube, a completely dry field is desirable for skin grafting The application of thrombin in this case leaves a very satisfactory dry clotted bed Thrombin may also be of particular value for dural oozing, bleeding over the facial nerve canal and where cautery or polishing burr may be inadvisable

It appears that thrombin is effective for the control of persistent veno-capillary oozing In the tonsillar fossa and adenoid bed following tonsillectomy and adenoidectomy, thrombin may be valuable where there is persistent veno-capillary ooze from muscle or mucous membrane This is of particular importance where further manipulation and efforts to ligate the bleeding points appear to increase the bleeding

From both a theoretical and a practical point of view, the use of thrombin spray in the nose appears ineffective Within our limited experience, we agree that thrombin may be of value for its adhesive and hemostatic qualities when applied to the septal flaps following submucous resections, particularly if it is desirable to avoid the use of nasal packing

Our experience in this study does not permit definitive conclusions as to the optimum concentration of thrombin for adequate hemostasis It has been our practice, in most circumstances, to use 500 u/cc, and no contraindications to this concentration have been found

Absorbable sponge saturated with thrombin was observed to have special application in otologic and sinus surgery The ease with which it can be prepared, molded, and applied to the ear makes it superior for use in ear surgery During radical mastoidectomy it is necessary to occlude the Eustachian tube in order to prevent Eustachian discharge from entering the radical cavity and also to provide a smooth bed for skin grafting Unfortunately, the physical characteristic of absorbable sponge makes it difficult to manipulate in the restricted openings and some failure to adhere to the canal walls is reported On the other hand, absorbable sponge was readily packed into the open recesses of the mastoid cavity following exenteration of cell tracts or where there was an unusually large mastoid cavity created by the necessity of removing a great deal of infected bone In these cases it appeared desirable to reduce the size and round out the cavity over which the skin graft was to be applied It is believed that more rapid healing occurred and post-operative care was simplified

Where a radical mastoidectomy was performed, and the facial nerve was found exposed by disease or was decompressed following injury, absorbable sponge was used as a protective cushion over the facial nerve It is believed that this procedure served to prevent direct apposition of skin graft to the nerve, and avoided undue pressure on the nerve

Using the patch technique absorbable sponge saturated with thrombin was applied with apparent impunity over lacerations or fistulas *into* the dura *In those surgical cases* where accidental laceration occurred and there was a spontaneous flow of spinal fluid, there was effective control with a single exception In this instance an attempt was made to control spinal fluid leakage from the roof of the sinus cavity without success

Where there was a flow of purulent secretion through a dural fistula (frontal lobe abscess), an absorbable sponge was applied It would appear that the sealing off of a fistula into an infected intracranial lesion would be contrary to good surgical principles, *yet the post-operative results in two cases reported have been strikingly good* In these cases it was impossible to ascertain whether the patch remained intact since there was no opportunity to re-examine the lesion postoperatively

It appears from the literature that absorbable sponge may allow for healing of a vessel wall without formation of an occluding mural thrombus If absorbable sponge is applied over the incision in the *lateral* sinus after the bleeding is controlled by packing both *ends of the* exposed lateral sinus, it is conceivable that upon removal of the packs secondary hemorrhage *may* be prevented, and may allow for more rapid recanalization Further data are necessary on this point.

If a *vigorous* bleeding point in the nose is controlled by packing with vaseline gauze and *the* gauze removed at a later date, bleeding may recur as a result of disturbing the *blood* clot It appears reasonable *to* assume that if *the bleeding* point is *first* covered with an absorbable sponge *and then* pressure with surgical gauze is superimposed, the bleeding point is not only controlled by the pressure, but when the pack is removed later, the "anchorage clot" and protective sponge covering remains undisturbed and the bleeding may not recur In the nose, where it was possible to visualize the bleeding point, such a procedure was followed with some good results In the majority of cases, particularly where the bleeding point was posterior and lateral in the nose, some difficulty was encountered The physical characteristics of the absorbable sponge and limited space within the nose made it difficult to apply the sponge and to obtain sufficient counter-pressure

Although the good report on the use of absorbable sponge as an "intraseptal bridge" in cases of through and through perforation following submucous resection is limited to two cases, it is believed worthy of further observation and investigation as a simple method of avoiding a troublesome and sometimes difficult post-operative problem

CONCLUSIONS

1 Thrombin was useful in controlling veno-capillary oozing after tonsillectomy and adenoidectomy Vigorous venous and arterial bleeding were not controlled by the use of thrombin

2 The application of thrombin may be of value in the control of veno-capillary ooze from the nose, but brisk bleeding from Little's area or from the lateral nasal wall was not controlled

3 Thrombin, when applied to the middle ear following radical mastoidectomy, provided a dry bed for skin grafting It was effective in cases of bone and soft tissue oozing, dural and lateral sinus bleeding where epinephrine failed and where cautery was deemed inadvisable

4 Absorbable sponge saturated with thrombin was demonstrated to be an innocuous and valuable adjunct for use in the following surgical procedures

a Good results were obtained during radical mastoidectomy, *e g*, obliteration of inaccessible parts of the mastoid cavity prior to skin grafting

b It was found useful to patch lacerations and incisions of the dura, jugular bulb, and lateral sinus

c It was used successfully as an innocuous hemostatic agent as well as a protective cushion over the exposed facial nerve

d The sponge was used to protect linear tears in the membranous flap during the fenestration operation

e Good results were obtained in radical neck dissection where unusual bleeding followed X-ray therapy

f Promising results were obtained in the use of a thin sheet of sponge as an "intraseptal bridge" in cases of post-operative through and through perforations of the nasal septum

g Unsatisfactory results were obtained when the sponge was used in an attempt to control brisk bleeding from the lateral nasal wall

5 No methods could be devised for the safe use of absorbable sponge in the oropharynx or nasopharynx

BIBLIOGRAPHY

1 OGURA J H, and SENTURIA B H Epistaxis The Laryngoscope 59 7 743 763, July, 1949

2 CUSHING HARVEY The Control of Bleeding in Operations for Brain Tumors With the Description of Silver Clips for the Occlusion of Vessels Inaccessible to the Ligature *Ann Surg* 54 1 19 July 1911

3 MELLANBY J Thrombase Its Preparation and Properties *Pro Roy Soc*, London Series B 113 93 106 June 1 1933

4 SEEGERS W H BRINKHOUS K M SMITH H P and WARNER E D The Purification of Thrombin *Jour Biol Chem* 126 91 95 Nov 1938

5 BERING E A JR Chemical, Clinical and Immunologic Studies on the Products of Human Plasma Fractionation XX—The Development of Fibrin Foam as a Hemostatic Agent and for Use in Conjunction with Human Thrombin *Jour Clin Invest* 23 586 590 July 1944

6 Correll, J T , Prentice, H R and Wise, E C Biologic Investigations of a New Absorbable Sponge *Surg Gynec and Obst* 81 585 589 1945

7 Frantz, V K Absorbable Cotton Paper and Gauze (Oxidized Cellulose) *Ann Surg*, 118 116 126, July 1943

8 Spitz, E B , Ziff, M , Brenner, C and Davison C A New Absorbable Material for Use in Neurological and General Surgery *Sci* 102 621 622 Dec 14, 1945

9 Bice, C W , MacMasters, M M and Hilbert, G E Proposed Use of Starch Sponges as Internal Surgical Dressings Absorbable by the Body *Sci*, 100 227 228 Sept 8, 1944

10 Seegers, W H and McGinty, D A. Further Purification of Thrombin Probable Purity of Products *Jour Biol Chem* 146 511 518 Dec 1942

11. Seegers, W H , Warner E D Brinkhous K. M and Smith H P The Use of Purified Thrombin as an Hemostatic Agent *Sci* 89 86 Jan 27 1939

12 Tidrick, R T , Seegers W H and Warner E D Clinical Experience with Thrombin as an Hemostatic Agent *Surg* 14 191 196 Aug 1943

13 Correll, J T and Wise E C Certain Properties of a New Physiologically Absorbable Sponge *Proc Soc Exper Biol and Med* 58 233 235 1945

14 Correll, J T and Wise E C The Stability of Thrombin Penicillin or Streptomycin in the Presence of Gelatin Sponge Oxidized Cellulose or Each Other *Surg, Gynec and Obst* 85 211 213 Aug 1947

15 Jenkins, H. P, and Clarke, J S Gelatin Sponge a New Hemostatic Substance Studies on Absorbability *Arch Surg* 51 253 261 Nov Dec 1945

16 Pilcher, C and Meacham, W F Absorbable Gelatin Sponge and Thrombin for Hemostasis in Neurosurgery *Surg Gynec and Obst* 81 365-369 1945

17 Light R U and Prentice, H R Gelatin Sponge Surgical Investigation of a New Matrix Used in Conjunction with Thrombin in Hemostasis *Arch Surg* 51 69 77 Sept. 1945

18 Light R U, and Prentice, H R Surgical Investigation of a New Absorbable Sponge Derived from Gelatin for Use in Hemostasis *Jour Neurosurg* 2 435-455 Sept. 1945

19 Jenkins H P Senz E H Owen H W and Jampolis R W Present Status of Gelatin Sponge for the Control of Hemorrhage *Jour A M A.*, 132 614 619 Nov 16 1946

20 Seegers W H and Sharp E A. Hemostatic Agents Chas C Thomas 1948 Chap 2 (Mechanics of Topical Hemostasis with Thrombin)

21 Tidrick R T Recent Advances in Surgical Hemostasis Evaluation of Absorbable Agents *Tran Amer Acad Ophthal and Otol* Sept Oct 1947

22 Fox, S L Use of Thrombin in Rhinologic Surgery The Laryngoscope, 56 48 1946

23 Reading P Some Uses of Thrombin in the Surgery of the Ear Nose and Throat. *Brit Med Jour* 2 295-296 1946

CLINICAL RELIABILITY OF BONE CONDUCTION AUDIOMETRY *

RAYMOND CARHART, Ph.D., and CLAUDE HAYES, M.A.,
Evanston, Ill.

– I –

Bone conduction audiometry has received much criticism in past years. Otologists and audiologists distrust thresholds obtained by bone conduction because of fear that the methodology possesses two limitations. The first supposed limitation is lack of *validity*, or inadequacy of the norms for bone conduction because of variations introduced by differences in skull structure, positioning of the vibrator, and other factors. The second supposed limitation is doubtful *reliability*, or excessive discrepancy between test and retest measurements due to positioning, vibrator pressure, and related influences. The value of bone conduction audiometry as a diagnostic aid must remain in doubt until research has clarified the validity and reliability which may be expected when bone conduction thresholds are obtained under clinical conditions.

Several investigators have dealt with aspects of bone conduction audiometry which are pertinent to the present study. These contributors include Witting and Hughson,[5] Lierle and Reger,[2] McNally and his associates,[6] Senturia and Thé,[4] Greenbaum, Kerridge and Ross,[3] and Beasley in the National Health Survey.[1] The work of these men leads to two beliefs: *1* that bone conduction measurements on normal ears show only slightly greater variability from the theoretical normal curve than is shown by the comparable air conduction thresholds, 2 that bone conduction thresholds are reasonably reliable, however, there appears to be little evidence bearing on the question of how closely a patient's bone conduction thresholds *on repeated tests* may be expected to agree with one another

---

*Presented at the Eighty-second Annual Meeting of the American Otological Society, New York, N. Y., May 18, 1949.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication June 1, 1949.

Reasonable interpretation of an audiogram obtained under clinical conditions cannot be made until information is available on this latter point The margin of uncertainty for bone conduction audiometry, as contrasted to the margin of uncertainty for air conduction thresholds, must first be defined It is this topic with which the present investigation deals Specifically, the primary aim was to compare test-retest reliability on air and bone conduction results as gathered in a clinical situation on a heterogeneous population of patients with hearing loss Thus, the study is concerned purely with the question of *reproducibility of thresholds* The study is not concerned with the question of validity In other words, it is not concerned with whether observed thresholds are true representations of the amount of hearing loss This latter topic is obviously important, but it is beyond the scope of the investigation here reported

– II –

The data forming the basis for this investigation were audiometric records taken from the files of the Aural Rehabilitation Program at Deshon General Hospital Two series of audiograms were compared namely, an initial audiogram and a second audiogram for each patient in the group Within the limits of the Deshon population, the data represented an unselected sampling in terms of age, duration of hearing loss, audiometric pattern, type of hearing loss, linguistic ability, and intelligence, however, Army regulations were such that very few patients with near-normal hearing were included Otherwise, the degree of loss also varied widely

The audiometric data were drawn alphabetically from the Deshon files but only records meeting the following criteria were selected

1. The initial test and the retest must have been administered with the same audiometer. (This precaution eliminated variations in threshold due to differences between instruments.)

2. The two tests must have been given approximately a month apart. (This precaution reduced differences which might be due to progressive deterioration in the hearing of some patients.)

3. Measurable thresholds must have been obtained on at least three frequencies by both air and bone modalities, as well as on both tests. (This requirement was necessary to yield a reasonable number of test-retest comparisons for each frequency investigated.)

4. All tests must have been administered between November, 1944, and May, 1946. (This time limitation was imposed because improved standardization of bone conduction testing was available at Deshon between these dates.)

5. The same masking technique must have been employed on both tests. (This precaution guarded against large differences, particularly in bone conduction thresholds, which might be due to variations in masking.)

6. Cases were ruled out if their records suggested either a psychogenic or a central factor. (This precaution guarded against the large test-retest variations which are typical when such factors are present, and which may not be considered as indicative of the reliability of the audiometric technique *per se*.)

The study was limited by original plan to evaluate data on 250 patients (500 ears). It developed that the criteria were sufficiently rigid, particularly in the requirement that the same audiometer be used for both tests, so that almost the entire case file had to be surveyed to extract the 250 sets of data.

- III -

The group under investigation encompassed wide ranges in both degree and contour of hearing loss This fact is illustrated in part by Fig 1, which summarized the monaural averages (512-2048 c p s) revealed by the initial audiograms for the 500 ears under investigation The air conduction averages evidenced the wider spread by ranging from —5 db to 90 db of hearing loss, with a mean loss of 43 db and a standard deviation of 14 7 db The bone conduction average ranged from —10 db to 55 db, with a mean loss of 15 db and a standard deviation of 13 6 db, however, as can be seen from Fig 1, the distributions for both sets of scores were somewhat skewed, the air conduction scores being skewed negatively and the bone conduction positively

The patients were predominantly young males, but their ages ranged from 19 to 62 years

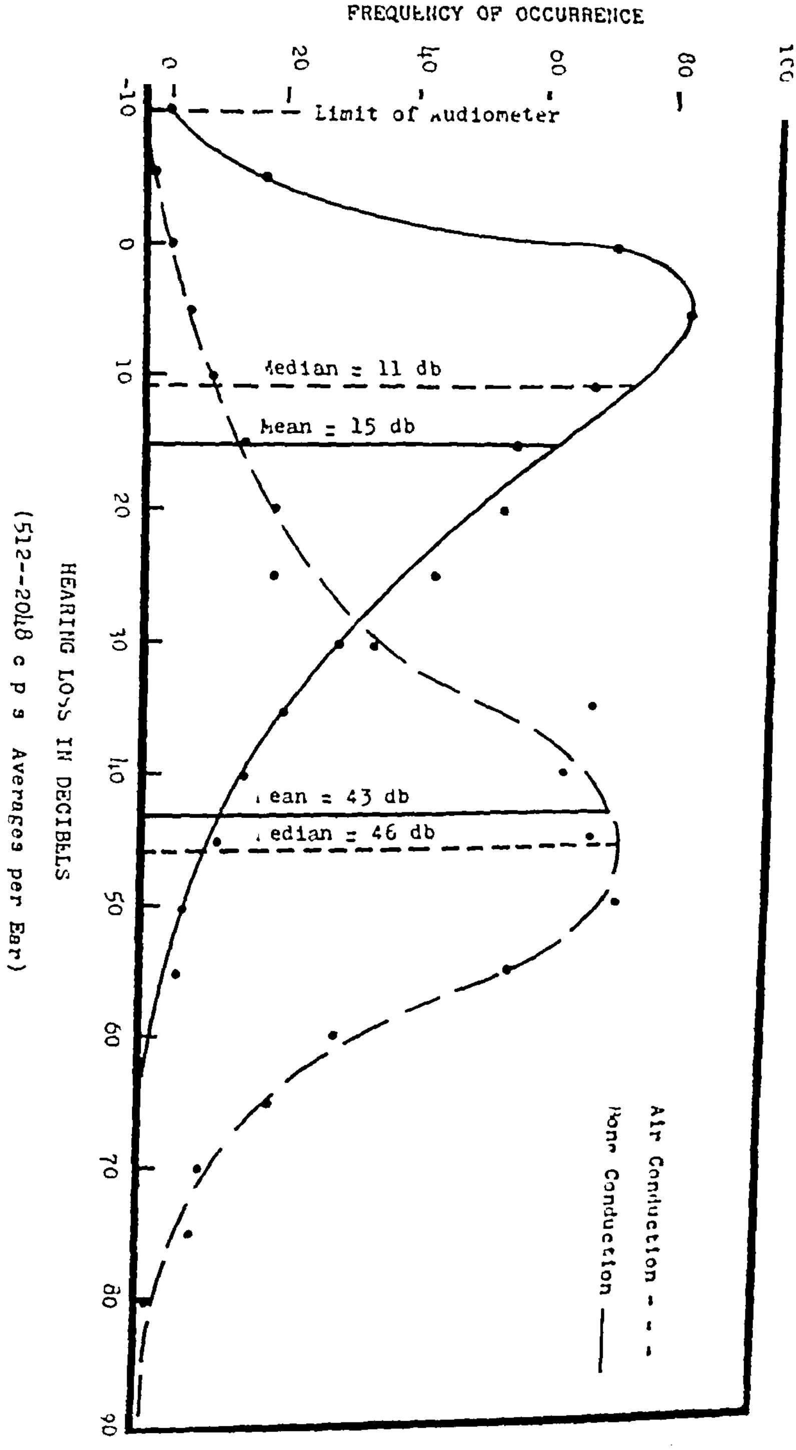
The distribution of the diagnoses supplied by the medical officers were

Conductive loss	79
Mixed loss—predominantly conductive	37
Mixed loss	61
Mixed loss—predominantly perceptive	14
Perceptive loss	55
Normal hearing	4
Total	250 cases

The group was limited to men with reasonable understanding for speech. It seems safe to assume that otherwise the range of intelligence and linguistic ability of the group was great, although no quantitative data on these factors were at hand

- IV -

The audiometric technique employed at Deshon was the ascending method advocated by Hughson and Westlake[4] Careful rather than rapid testing was emphasized One half-hour was allotted for each pure tone test


FREQUENCY OF OCCURRENCE
0
20
40
60
80
100
Limit of Audiometer
Median = 11 db
Mean = 15 db
Mean = 43 db
Median = 46 db
Air Conduction - - -
Bone Conduction ———
-10
0
10
20
30
40
50
60
70
80
90
HEARING LOSS IN DECIBELS
(512--2048 c p s Averages per Ear)

The tests were administered in special chambers with superior acoustic characteristics

Three types of commercial audiometers were employed routinely namely, the Western Electric 6B, the Sonotone 20, and the Maico D5 The Western Electric and Sonotone instruments were used as supplied by the manufacturers, *i e*, each with its original air conduction and bone conduction receivers The same was true for the air conduction testing performed with the Maico instruments Here, however, bone thresholds were obtained with an auxiliary unit activated by the audiometer This auxiliary system consisted of an amplifier, a matching transformer, a meter, and a bone conduction receiver of the hearing aid type held in a steel headband

The auxiliary bone unit was calibrated by testing normal persons in a special sound-proof room. Once the calibration was determined, it was possible to standardize the entire system relative to the attenuator scale on the audiometer This was done by adjusting the output of the amplifier to yield the required voltage as read on the meter Obviously this voltage varied from one frequency to another — since the characteristics of the circuits, the bone oscillator and the human mechanism were involved, however, once the standard had been determined, conditions could be reproduced at will From this point onward, audiometry proceeded according to the ascending threshold technique

With the exception of the auxiliary system just described, thresholds (for both air and bone) were read as calibrated by the respective manufacturer, however, these calibrations were routinely checked against normal ears and any discrepancies corrected

– V –

The data under investigation incorporate uncontrolled variables of several types Factors such as age, pattern of hearing loss, and duration of loss have already been mentioned Another variable involved actual fluctuations in some patients' hearing between the initial test and the retest Then, too, five audiometrists administered the tests under consideration Al five were well trained and used the same testing technique however, no attempt was made to select only cases where the same audiometrist administered the two tests for a particular patient. It was felt that a somewhat more realistic estimate of the clinical reliability would be forthcoming if the retest were administered by a person not having prior knowledge of the patient's hearing

Stated differently, the criteria for selection of cases were chosen with the view of minimizing those variables in the Deshon situation which might obscure the basic issue namely, the test-retest reliability of bone conduction thresholds By contrast, variables which were deemed inherent in clinical practice were ignored in the criteria for selection The assumption here was that, although failure to control such variables would reduce reliability in comparison to that of the laboratory situation, the results would constitute a fairer indication of the clinical efficiency of bone conduction audiometry The simultaneous exploration of reliability for air conduction thresholds furnished a further reference against which to evaluate the findings for bone conduction

– VI –

The statistical treatment of the data involved analysis of a series of Difference Scores derived from the audiometric data The procedure in computing each Difference Score was to subtract the appropriate threshold reading on the retest from the corresponding reading on the initial test Thus, each Difference Score was a direct numerical statement of the magnitude and direction of discrepancy between the test-retest readings Specifically, *1* a positive Difference Score represented a poorer threshold on the first test than on the second one, *2* a negative Difference Score indicated the reverse, and *3* a Difference Score of zero was obtained when the companion thresholds were identical on both tests The procedure eliminated from consideration the amount of loss represented by a particular threshold and centered upon test-retest agreement or discrepancy

Difference Scores were computed for each test frequency from 256 through 4096 c p s * In addition, average (or composite) Difference Scores for the 256–4096 c p s range were obtained, furthermore, these various sets of Difference Scores were computed from both the air conduction and bone conduction data

The various sets of Difference Scores were compared with one another statistically To this end, the mean Difference Score and the standard deviation of Scores were determined for each set Next, t tests were employed to estimate the statistical significance of divergencies in the means and standard deviations for the various sets of scores,[2] moreover, the correlation between air and bone results (for individual frequencies and for the composite of all frequencies) was computed by the product-moment method

The results of the statistical analyses are discussed below under five headings namely, *1* central tendencies of the data, *2* variability of the test-retest comparisons, *3* correlation between threshold shifts for air and bone conduction, *4* intra-frequency variations in test-retest reliability, and *5* variation in test-retest reliability with different audiometers

– VII –

As can be seen from Table I, all of the means of Difference Scores for air conduction were close to zero both for each frequency considered separately and in the composite The greatest negative diverge was yielded by the data for 512 c p s (— 55 db), while 4096 c.p s yielded the largest positive mean (35 db) Other values ranged between these extremes Similar findings emerged for bone conduction Here the range of means was from — 25 db (for 1024 c p s) to 55 db (for 2048 c p s) Thus, the central tendencies for both air and bone conduction fall within a very limited range These findings favor the assumption that uncontrolled variables were randomly distributed For a given set of thresholds, the shifts in one direction (from test to retest) were almost completely counterbalanced by shifts in the other direction

---

*Only frequencies from 256 through 4096 c.p s were considered because the available data on bone conduction thresholds were limited to this range.

TABLE I

Mean Difference Scores, in DB, Derived from Test Retest Thresholds for Air Conduction and Independently, for Bone Conduction Also t Scores Indicating Significance of Discrepancies in Means for Air and Bone

Frequency	256	512	1024	2048	4096	Composite
No of Comparisons	495	498	499	482	403	2377
Air	—15	—55	—30	25	35	—10
Bone	40	15	—25	55	10	20
t Scores*	1 265	1 528	208	611	429	1 311

*t Score of 1 966 and 2 588 significant at 5% and 1% level

Table I also summarized t scores derived when the means for air conduction were compared with those for bone conduction The largest t score was 1 528 for 512 c p s (where 1 966 is required for 5 per cent significance) Hence, neither the results for individual frequencies nor for the composite may be interpreted as indicating a significant difference between the central tendencies for air conduction and bone conduction In other words, there was no evidence of a systematic variation, due to the modality of stimulation, in the test-retest counterbalance of variables in the Deshon situation

The foregoing findings confirm the belief that the data under consideration are adequate for purposes of the present study No statistical evidence emerged which suggested systematic differences between first and second tests Neither was there any statistical evidence of significant dissimilarity in the central tendencies for the air and the bone conduction modalities Finally, the results lead to the conclusion that, for the group as a whole, the general level of hearing loss did not change between the first and second tests

- VIII -

The standard deviations of the several sets of Difference Scores were used as the basis for estimating test-retest variability. The comparative sizes of these standard deviations give an indication of the relative reliabilities of thresholds at different frequencies and for the two different test modalities.

The standard deviations computed from the present data are summarized in Table II. One notes that, for the air conduction data, the standard deviations for individual frequencies ranged from 8.35 db to 9.70 db. The smallest standard deviations were for frequencies 512 to 2048 c.p.s., with the least variability falling at 1024 c.p.s. This finding is not an unexpected one in the light of earlier studies, and it will be discussed later. The standard deviation, by air conduction, for the composite of all frequencies was 9.10 db.

The variability recorded in Table II is considerably greater than the 5 db reported by Witting and Hughson,[8] who made a total of 297 tests on 17 patients under strict research conditions. One concludes that the reliability of the audiometry conducted at Deshon was less than achievable under more exacting control of test conditions; however, the reliability of the methodology itself was probably somewhat better than the figures in Table II would seem to indicate because such factors as actual changes, between tests, in threshold acuity contributed to the sizes of the standard deviations.

TABLE II.

Standard Deviation of Difference Scores in DB Derived from Test Retest Thresholds for Air Conduction and Independently for Bone Conduction. Also t Scores Indicating Significance of Discrepancies in Standard Deviations for Air and Bone. Plus Coefficient of Correlation Between Difference Scores for Air and Bone.

Frequency	256	512	1024	2048	4096	Composite
No of Comparisons	495	498	499	482	403	2377
S D Air	9.25	9.15	8.35	9.15	9.70	9.10
S D Bone	7.70	8.35	7.65	9.05	9.40	8.45
t Scores*	4.394	2.282	2.159	192	600	4.061
Coeff Corr	35	33	36	33	32	34

*t Score of 1.966 and 2.588 significant at 5% and 1% levels.

Turning to the results for bone conduction, one notes that the standard deviations ranged from 7.65 db to 9.40 db for the various test frequencies, with 8.45 db as the composite. Again the smallest value was that for 1024 c p s, and with this exception the variability tended to increase as the test frequency became higher.*

Table II also reveals that the standard deviations of the Difference Scores by air conduction were all larger than the standard deviation for the same frequency by bone conduction. In other words, the present data did not reveal as much variability in retesting bone conduction thresholds as in retesting the corresponding air conduction thresholds. This finding is in conflict with the general belief in the field and is contrary to the expectation which the authors held prior to undertaking the study.

Fuller interpretation of the finding just mentioned was possible through the application of t tests, which allowed one to estimate the significance of observed differences in the standard deviations for air and bone. Table II also presents the results of these t tests. The t scores for 2048 and 4096 c p s (0.192 and 0.600, respectively) fall substantially below the level of statistical significance. One concludes that, for these two frequencies, the reliability of air conduction and bone conduction testing was approximately equivalent in the population here studied. By contrast, the t scores for 256, 512, and 1024 c p s (1.391, 2.282 and 2.159, respectively) reached statistical significance.† In each of these instances the standard deviation for air conduction was larger than that for bone conduction. Similarly, the standard deviation was smaller by bone for the composite of all frequencies. Here the t score (4.061) exceeded 1 per cent significance.

---

* The small standard deviation for bone at 256 c p s is probably in part an artifact. Many cases at this frequency obtained normal or better than normal thresholds on the first test. These cases were limited in the [illegible] measurable retest variation which could be observed when the shift was in the direction of hyperacuity. Had this restriction not been operative, the variability for 256 c p s would probably have been found to be greater than here reported.

† Actually although the t score for 256 c p s most exceeded the 1 per cent level of significance, the probable artifact already mentioned undoubtedly accounted in part for the magnitude of the t score.

One might conclude that the above findings reveal bone conduction measurement to have been more reliable than air conduction measurements, however, this conclusion needs modification because the total intensity range of thresholds by bone conduction was 70 db (from 10 db better than normal to a loss of 60 db) while the range for air was 110 db (from 10 db better than normal to a loss of 100 db) * Since the criteria for case selection required that most thresholds fall within these ranges on both tests, the end-result would be a comparative restriction in the number of extreme variations to be found in the data for bone conduction The statistical influence would be a decrease in the standard deviation, therefore, the most reasonable interpretation of the results reported above seems to be that in the Deshon situation, the test-retest reliability of bone conduction thresholds was equivalent to the reliability for air conduction One concludes *the common opinion that bone conduction thresholds are substantially less repeatable than air conduction thresholds does not apply when reasonable precautions are taken to insure control of the bone conduction technique*

– IX –

The degree to which the data for air and bone conduction evidenced parallelism, in the threshold difference between initial test and retest, was estimated by the product-moment method Table II summarizes the coefficients of correlation which were obtained All correlations were of the order of r = + 33 Coefficients of this magnitude may be interpreted as showing a low but positive parallelism In other words, individual patients evidenced a tendency to yield Difference Scores for air conduction and for bone conduction which were of like sign and of like magnitude, although many subjects deviated from this pattern

Assuming this finding to be evidence that true fluctuations in hearing were involved in the data, the variabilities *due to*

---

*The reader will recognize that these ranges varied somewhat with test frequency and with the make of audiometer but this fact is of secondary importance at the moment.

the audiometric technique itself are probably more accurately represented by the standard errors of estimate.[*] Table III reports the standard errors of estimate for the different test frequencies and the two test modalities. One notes that these standard errors range from 7.15 to 9.18 db. Thus, test-retest variability remained relatively large in the Deshon situation even after a reasonable correction for probable fluctuations in patients' acuity.

TABLE III

Standard Error of the Estimate of Difference Score in DB

Frequency	256	512	1024	2048	4096	Composite
Air Conduction	8.70	8.65	7.82	8.65	9.18	8.58
Bone Conduction	7.24	7.90	7.15	8.55	8.90	7.91

– X –

The comparative variability of thresholds, from one frequency to another, was estimated by t tests applied to the standard deviations of the Difference Scores. Tables IV and V report the results for air conduction and bone conduction, respectively.

The only significant t scores in Table IV are those in which 1024 c.p.s. was compared with the other test frequencies. Thus, 1024 c.p.s. is the only frequency which was found to be significantly less variable than any other frequency when tested by air conduction. This finding agrees with the conclusion of Witting and Hughson that the inherent error in repeating audiograms is a function of frequency and that 1024 c.p.s. yields "maximum ease of listening."[4]

As shown by Table V, similar results emerged for bone conduction. Here, however, 256 c.p.s. was not distinguished significantly from 1024 c.p.s.,[†] while 4096 c.p.s. was significantly separated from all other frequencies but 2048 c.p.s. Thus, the dependence of the inherent error upon frequency appears, on the basis of the data at hand, to be more pronounced for bone conduction thresholds than for air Most noteworthy is the fact that, in general, thresholds for 1024 c.p s again seemed to be more precise than those for other frequencies

---

[*] These estimates are derived by revising the standard deviations in terms of the coefficients of correlation.[2]

[†] This finding was probably due to a spurious reduction in variability for 256 c.p.s. which has been already mentioned as a likely artifact inherent in the data.

TABLE IV

t Scores Derived from Comparison of the Standard Deviations of Air Conduction Difference Scores for the Various Test Frequencies

Frequency	512	1024	2048	4096
256	.238	2.308	.238	1.011
512		2.051	.000	1.236
1024			2.051	3.034
2048				1.236

t Scores of 1.966 and 2.588 are significant at 5% and 1% level. Number of Difference Scores ranged from 499 to 403 (see Table I)

TABLE V

t Scores Derived from Comparison of the Standard Deviations of Bone Conduction Difference Scores for the Various Test Frequencies

Frequency	512	1024	2048	4096
256	1.831	.408	3.462	4.048
512		1.972	1.795	2.500
1024			3.590	4.167
2048				.787

t Scores of 1.966 and 2.588 are significant at 5% and 1% level. Number of Difference Scores ranged from 499 to 403 (see Table I)

– XI –

A comparison was made of the standard deviations of Difference Scores obtained with two of the seven audiometers involved in the present investigation The purpose was to determine whether the audiometer influenced the reliability of test-retest scores

The two audiometers being compared were of different makes They are here designated as instrument X and instrument Y, since the writers do not feel justified in drawing conclusions regarding the relative efficiencies of types of instrument from a single representative of each kind.

TABLE VI

Standard Deviations for Composite of All Frequencies for the Air Conduction and Bone Conduction Difference Scores Obtained with Two Different Audiometers. Also t Scores Indicating Significance of Discrepancies in Standard Deviations for the Two Audiometers. Standard Deviations Reported in DB

	Audiometer X 108 Ears	Audiometer Y 151 Ears	t Score*
S D Air	10.95	8.10	4.61
S D Bone	9.85	6.95	3.75

*A t score of 3.25 is here significant at 1% level.

Findings are reported in Table VI. Instrument X yielded larger standard deviations, for both air conduction and bone conduction measurements, than did Instrument Y. For both modalities of stimulation the t scores exceeded the 1 per cent level of statistical significance. One concludes that the reliability of pure tone thresholds is partially dependent upon the particular audiometer used; however, this conclusion does not contradict the earlier finding that, under proper control, bone conduction thresholds have as great test-retest reliability as air conduction thresholds.

- XII -

In summary, the present study was a statistical investigation of the comparative reproducibility, i.e., test-retest reliability, of air conduction and bone conduction thresholds. The study was not concerned with the question of validity, i.e., the adequacy of the norms for the two modalities of stimulation; furthermore, the study was based upon tests administered under clinical conditions.

Sets of data on 250 cases were selected from the records of the Aural Rehabilitation Program at Deshon General Hospital. Each set consisted of an initial audiogram and a second audiogram obtained approximately a month later. Selection as limited to test results in which both the air conduc- ion and bone conduction measurements were reasonably com- lete Other restrictions, such as the requirement that both ests must have been given with the same audiometer, were bserved in the selection of data

The 250 cases represented the major types of auditory im- airment and encompassed a wide range in degree of loss he average loss (over the 512-2048 c p s range) was 43 db y air conduction and 15 db by bone conduction

Seven commercial audiometers, some with special adapta- ons to improve bone conduction testing, were used in admin- stering the tests under consideration All bone oscillators ere of the hearing aid variety

Test-retest agreement, both for individual frequencies and the aggregate, was expressed in Difference Scores which epresented the degrees and directions of discrepancies be- veen the two tests The Difference Scores were subjected to atistical comparisons The comparisons included determina- on of the means and standard deviations of Difference cores, estimation of the significances of divergencies through tests, and computation of correlations between the Difference cores for air conduction and bone conduction All compari- ons were based upon the number of ears for which appro- riate Difference Scores were available

The main findings and conclusions were as follows

1 The means of all Difference Scores approximated zero and the corresponding t tests were non-significant Thus, for a given set of thresholds, the shifts in one direction were almost completely counterbalanced by shifts in the opposite direction For the group as a whole, the general level of hearing did not change between the first and second tests, and the data were adequate for the purposes at hand

2 The standard deviations for the air conduction data were somewhat larger than for the corresponding bone conduction measurements The discrepancy reached statistical significance for 256, 512, and 1024 c p s, as well as for the composite of all test frequencies In other words, the test-retest reliability of bone conduction thresholds was here found to equal or exceed that for air conduction measurements It follows that *the repeat accuracy of bone conduction measurements may be as good as that for air conduction thresholds when appropriate precautions are taken in testing*

3 Low but positive parallelism between air and bone conduction measurements characterized test-retest shifts in threshold This parallelism was revealed by correlations approximating r = + 33 for all frequencies

4 The inherent error of pure tone audiometry varied somewhat with frequency and the differences reached statistical significance in some instances In particular, the reliability of threshold for 1024 c p s emerged as superior in both modalities of stimulation

5 Comparison of results obtained with two different audiometers revealed significant superiority for one instrument by both air and bone conduction Thus, the reliability of pure tone thresholds is partially dependent upon the audiometer used

As a final comment, two points should be re-emphasized First, the present study did not deal with the question of threshold validity, *i e*, with the determination of stimulus levels required to reach normal thresholds Rather the study was concerned with the relative reproducibility of air and bone thresholds Second, the findings here reported contradict a commonly held opinion namely, that the inherent error in bone conduction audiometry is woefully large compared to the error inherent in stimulation by air conduction The present findings demonstrate that, in a clinical situation, the two modalities of stimulation can possess similar reliability Thus, *bone conduction measurements whose precision is clinically acceptable may be anticipated whenever proper control of test conditions is maintained*

BIBLIOGRAPHY

1. Beasley, W Normal Hearing by Bone Conduction National Health Survey, Hearing Study Series, Preliminary Report, Bull 4, 1935 1936

2. Edwards, A. L Statistical Analysis for Students in Psychology and Education. New York Rinehart Co, 1946

3 Greenbaum, A., Kerridge, P, and Ross, E. Normal Hearing by Bone Conduction. *Jour Laryngol and Otol*, 54 88 92, 1939

4 Hughson, W., and Westlake, H Manual for Program Outline for Rehabilitation of Aural Casualties Both Military and Civilian *Tran Amer Acad Ophthal*, supp, 1944

5 Lierle, D, and Reger, S Correlation Between Bone and Air Conduction Acuity Measurements Over Wide Frequency Ranges in Different Types of Hearing Impairments. The Laryngoscope, 56 187 224 1946

6 McNally, W, Erickson, T, Scott Moncrieff, R and Reeves D Clinical Observations of Bone Conduction *Jour Laryngol and Otol* 52 295-430, 1937

7 Senturia, B, and Thea, A. Bone Conduction in Audiometry Part 1 Literature Review and Report of Preliminary Observations The Laryngoscope, 52 675-687, Sept, 1942

8 Witting, E., and Hughson W Inherent Accuracy of a Series of Repeated Clinical Audiograms The Laryngoscope, 50 259 269 Mar 1940

TOPICAL ANESTHESIA IN ENDOSCOPY*†

A Critical Evaluation with Case Reports and Survey of Current Opinion

MILTON R. HIMALSTEIN, M.D.,
Oteen, N. C.

INTRODUCTION

The average young otolaryngologist uses topical anesthesia unconcernedly, generally keeping on with the drug and technique used during residency training. Although fully aware that a confrere occasionally runs into difficulty, he blissfully carries on confident in "his" procedure until rudely jarred by a serious reaction, or death. Having had no difficulty for possibly several hundred cases, he finally rationalizes that he is entitled to have a reaction. Judging from the material published, at some fateful time a series of accidents may befall him, he then proceeds to question his more experienced confrères and search the literature. Such was my experience and response. In an effort to determine the present concept of safe yet efficient topical anesthesia for laryngoscopy, bronchoscopy and esophagoscopy, the literature was carefully considered, and in conjunction with Dr. E. J. Chapman questionnaires were sent to the members of the American Broncho-Esophagologic Association. The findings were evaluated and my procedure was modified accordingly. A brief summary of the literature, case reports, results of the survey and my impressions are submitted herewith.

---

*Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

†Grateful acknowledgment is made to Dr. E. J. Chapman of Asheville, N. C., Consultant in Broncho-Esophagology, for his advice and co-operation in this study.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication June 15, 1949.

CHEMISTRY AND PHARMACOLOGY

Thomas and Fenton,[1] quoting Hirschfelder and Bieter (1932), divide local anesthetics into four groups

Group I—Benzoyl derivatives, including cocaine Cocaine is a benzoic ester of methyl ecgonine Metycaine is also a benzoic acid ester

Group II—Para-amino benzoyl derivatives Pontocaine and procaine are related under this group Procaine is an esterification of para-amino benzoic acid and diethyl-amino-ethanol Pontocaine, butyn, larocaine and others are esterifications of para-amino benzoic acid and either aliphatic or amino alcohols

Group III—Phenetidin derivatives

Group IV—Quinoline derivatives

Adriani[2] combines Groups I and II as complex esters In summary, cocaine is a benzoic acid ester, pontocaine and procaine are para-amino benzoic acid esters All are basic alkaloids, the contained nitrogen accounting for the basicity They are *soluble* in lipoids, which accounts for their affinity to nerve tissue cells The actual mode of local action beyond this is not known, except in speculation

Factors affecting the usefulness of local anesthetic drugs are solubility, local irritation, potency and toxicity Potency and toxicity are not necessarily parallel They are an inherent part of the chemical structure of the drug By a structural modification of procaine, pontocaine is derived, which is 10 times as potent[2] and, according to method of testing on animals, 10 to 25 times as toxic Highly potent drugs as pontocaine are characterized by prolonged action Also, the establishment of anesthesia requires a longer time interval

Practical application of the information above, which will be discussed in more detail, is that where a known sensitivity to cocaine exists, it may be possible to use pontocaine without untoward reaction, or vice versa Likewise, with a history of sensitivity to procaine, sensitivity to pontocaine, a chemically related drug, should be suspected In using a drug as potent as pontocaine, it is wise to wait five to 10 minutes after the administration of a safe dose in order to judge the intensity of anesthesia rather than risk a reaction by impatiently increasing the dose

COMBINED USE OF TOPICAL AGENTS

As to the value of combined use of anesthetics, Sollmann[3] states that the efficiency of mixtures of the local anesthetics corresponds to more or less complete summations, generally without potentiation He states, further, that there would be little or no practical advantage in such mixtures The use of pontocaine and cocaine in the same patient has been explained on the basis that the cost of pontocaine is approximately half that of cocaine in comparable concentrations Then, why not use pontocaine altogether? This implies one of two things — either that cocaine is a more efficient anesthetic agent or that pontocaine would have to be used in relatively toxic doses to get a comparable effect

POTENTIATION

Regarding the use of other chemicals for potentiation of topical anesthetics, Sollmann[3] (1918) reported that potassium salts may give considerable potentiation, but that this seems to hold mainly for motor fibres and not for sensory fibres As to potentiation by alkalinization, Sollmann affirms that sodium bicarbonate increases potency of most local anesthetics two to four times, including their use for mucous membrane application This does not apply to pontocaine, since it is precipitated by alkalinization The mixtures, however, do not keep well and must be made just before use [Sollman (1918) and Gwinn and Ferber[4] (1936)] I am aware of no clinical reports evaluating alkalinization

ADRENALIN

The status of epinephrine in association with local anesthetics bears clarification Gard and Sachs studied this problem, using white mice, and correlated their work with some clinical studies The purpose of adding vasoconstrictors is twofold first, to retard local absorption and so reduce toxicity, and second, for hemostasis which is not concerned in topical anesthesia Several conflicting reports on the effect of epinephrine on toxicity are quoted Gurd and Sachs found that adrenalin in dilution of 1 85,000 was without effect on cocaine toxicity, but that concentrations of 1 50,000 or stronger actually increased toxicity They feel, then, that the doses recommended as maximum by the Mayer report[6] do not diminish toxicity, they merely have no effect upon it No appreciable difference was found between cocaine and procaine They point out that clinical articles making statements that adrenalin decreases toxicity without experimental backing warrant skeptical evaluation These investigators conclude that adrenalin does not seem to decrease toxicity It may increase it and the only advantage of adrenalin is in hemostasis, which is not relevant to topical anesthesia

Sollmann[3] states that it is desirable and often necessary to delay absorption of local anesthetics by constricting the local circulation by adding epinephrine He points out that the symptoms of cocaine poisoning are largely those of sympathetic stimulation and that a sensitization to epinephrine is a manifestation of major concern Thus, in hypersensitive individuals, the nervousness induced by the adrenalin may make them more susceptible to cocaine collapse

The following was extracted from the Mayer Report [6]

"Cocaine is not as readily destroyed in the liver as procaine and with large doses of cocaine combined with adrenalin, the synergistic action of cocaine and epinephrine then develops to cause death In any event, epinephrine should not be added in an amount of more than 1 mgm (1 cc of 1 1,000 solution) "

Dr Harry Gold, of the Department of Pharmacology, Cornell University Medical College, reported to the Mayer Committee that one-half of the average fatal dose of cocaine for *cats becomes fatal* with the addition of 0 18 mgm of epinephrine per kilogram to the cocaine

Fussgaenger and Schaumann[7] (1931) have shown that one drop of 1 1,000 adrenalin added to 10 cc of 0 5 per cent solution of pontocaine allows the use of twice the lethal dose when given subcutaneously in rabbits, five drops allowed five times the lethal dose No clinical corroboration is available

MORPHINE

Morphine also warrants consideration The Mayer Committee[6] concluded that morphine has a distinct field of usefulness in allaying the apprehension of nervous patients, but at the same time sounded a warning against the administration of large doses or repeated small doses because of its synergistic action with local anesthetics on the respiratory center *They also cautioned against the routine use of morphine and adrenalin in the treatment of reactions Sollmann[3] repeated this admonition Unger and Thomas, in discussing Thomas* and Fenton's[1] paper, agreed that morphine is contraindicated in allergic individuals

DETOXIFICATION

Derbes and Engelhardt[8] state that while many believe detoxification of local anesthetics takes place in the liver, Goldberg, Koster and Warshaw[9] (1913) feel that at least a fraction is rendered inert in the blood stream Adriani[2] points out that those drugs which are eliminated unchanged in the urine or are slowly detoxified are more toxic than those drugs which, like procaine, are hydrolyzed into the original acid and alcohol which comprise their structure Cocaine, he states, is only partially hydrolyzed This may explain the relative toxicity of cocaine as compared to procaine, but the theory falls down with regard to pontocaine, which supposedly breaks down like procaine Goodman and Gilman[10] (1911) point out that the liver can detoxify one minimum lethal dose of cocaine in 60 minutes It would seem wise to proceed with caution in the face of liver damage

IRRITANT QUALITIES

Dietrich and Beutner[11] tested various topical anesthetics on rabbits' eyes to determine their irritant qualities Procaine was found to be least irritating and next to procaine, cocaine In comparing cocaine and pontocaine, the highest nonirritant concentrations were 2 per cent for cocaine and 0 1 per cent for pontocaine As the clinical equivalent of 10 per cent cocaine is 1 or 2 per cent pontocaine, the irritant qualities of pontocaine become still more pronounced Jackson and McReynolds[12] affirm that pontocaine has a tendency to cause irritation in patients, which may persist for several days Schmidt[13] and Fussgaenger and Schaumann,[7] both writing in 1931, used pontocaine alone and found no irritation in the eye using 0 5 to 1 per cent in humans and 2 per cent in rabbits, however, the American manufacturer in the leaflet accompanying each bottle of 2 per cent pontocaine has this to say

"In the eye pontocaine hydrochloride occasionally causes a transient burning sensation, usually observed when using concentrations higher than 0 5 per cent On very rare occasions pontocaine hydrochloride, in sensitive patients, has produced lacrimation, photophobia and chemosis"

DRUG IMPURITIES

Thomas and Fenton[1] submitted to the Committee on Pharmacology and Chemistry of the American Medical Association specimens of 2 per cent pontocaine causing reactions, and these were reported free of impurities

EFFECT OF AGE OF PATIENT

Shumacker,[14] working with guinea pigs in two age groups, stated that there was no great difference in the median lethal dose He was of the opinion that reactions in the aged are due rather to the greater incidence of cardiovascular deficiences, liver damage, etc.

THE TOXIC REACTION

A discussion of the toxic reaction to local anesthetics becomes confusing when it attempts to go beyond a clinical description of various types of reaction One obvious fact is that an overdose will cause reactions of varying degree up to death Less well understood types of reaction are idiosyncrasy and allergy Questions raised and discussed, but by no means answered are listed In certain toxic reactions, respiratory paralysis occurs initially, with circulatory failure a late complication In others, circulatory failure appears to be primary One group of anesthetics is considered safer because there is a wide margin of safety between respiratory paralysis and circulatory failure Ether and procaine are in this group

In another group containing nupercaine (percaine) and chloroform, there is little differentiation Pontocaine is chemically related to procaine and may be expected to fall into the safer group, and some animal studies seem to corroborate this viewpoint Few articles give specific information based on detailed studies with regard to pontocaine There does exist, however, a certain amount of animal study and clinical evidence which is noncorroborative

Cocaine is believed to cause circulatory failure Lundy and Essex[15] place cocaine as only a probable member of the more dangerous group along with nupercaine and chloroform Sollmann, however, makes the statement that respiratory paralysis is the usual cause of cocaine deaths According to *Veterans Administration Bulletin*, No TB10 A-106,[16] death from cocaine poisoning is due to cardiovascular failure probably by direct action on the heart Neither Sollmann nor the *Bulletin* give the source of study, whether on animals, etc The question then arises "Is pontocaine a safer drug than cocaine on the basis that it causes primarily respiratory paralysis, which has some prospect of reversibility, whereas cocaine is a more dangerous drug in that it causes primarily circulatory failure as generally believed?"

The next question is "Is the effect purely central, purely peripheral (as direct myocardial action), or both?" Respiratory failure is commonly caused by the interference with respiration by convulsions

According to Shumacker,[14] when guinea pigs are given a lethal dose or more of procaine by any route where absorption presumably takes place slowly (subcutaneously or intramuscularly), the sequence of events is ordinarily fairly uniform In this order, he finds grogginess, diminution or loss of consciousness, irritative central nervous system phenomena, namely, muscular twitchings and purposeless movements, followed by generalized convulsions and finally death Intravenous procaine, on the other hand, in the same dose gives a more rapid "collapse" reaction with or without convulsions In Shumacker's opinion, the mechanism of death remains the same With either route of administration, he says, death depends upon the presence in the blood stream of a lethal concentration which is roughly the same, regardless of its source An interesting implication is that what are described by some writers as the separate "convulsive" and "collapse" types, with respiratory death in the first, and cardiac death in the second, are actually the same process, the only difference being the speed with which a lethal dose is built up Sollmann, in discussing cocaine poisoning, implies the same clinical course for cocaine He states that in rapid cocaine paralysis, the convulsive state, as well as the prodromal psychic phenomena, may not appear

After recording the sequence of events with relatively slow absorption of a lethal dose of procaine in guinea pigs Shumacker was impressed by the fact that cardiac and respiratory failure occur almost simultaneously After further experimentation on dogs, he stated

"The abrupt and almost simultaneous cardiac and respiratory failure suggests (rather) that death ensues from central medullary paralysis although this is not definitely proved"

He mentions the work of Knoefel *et al*, in 1930, *1* using intravenous cocaine on cats with the suggestion that death was due to direct paralysis of the heart, and *2* using subcutaneous cocaine with the suggestion that death was respiratory

Sollmann's description of cocaine poisoning roughly parallels that given for procaine in guinea pigs by Shumacker. The symptoms of cocaine poisoning, he feels, are largely those of sympathetic stimulation. He calls the reaction a sensitization to epinephrine. The effects, he points out, are mainly central, but partly peripheral. The circulatory effects are those of epinephrine poisoning with cardiac acceleration.

In describing the central actions of cocaine, Sollmann describes them as variable and complex, depending largely on dose. There is an initial stage of cerebral stimulation which is psychical and shows as alertness, loquacity, elation or anxiety and flutter. This is more marked in excitable individuals, and excitable individuals are more apt to develop reactions. This phase of initial stimulation may be absent in overwhelming cases or be only fleeting. These prodromal symptoms are often considered hysteria or apprehension by the uninitiated anesthetist.

Next comes depression characterized initially by incoordination. The author has seen this incoordination manifested as a fumbling and difficulty in holding on to the tongue. As with Shumacker's guinea pigs when given procaine, movements lose their purposive nature and become choreic. Then, as the central depression enlarges, generalized narcosis takes place. Last, epileptiform convulsions ensue and, as previously mentioned, in more severe reactions may be absent.

Fussgaenger and Schaumann, working in the pharmacological laboratory of the I. G. Farben Industry, stated in their summary that death from pontocaine is always due to respiratory paralysis with an unchanged heart. In the body of their paper, however, they chart that respiratory paralysis was the cause of death in all rabbits tested with novocaine and cocaine as well.

Most of the information above is based upon animal experimentation and cannot be unconditionally applied to humans. Its practical value will evolve only when correlated with carefully observed and impartially studied clinical cases, which, in turn, are of no value unless honestly reported in the literature McCluskey,[17] in an article expounding the relative safety of pontocaine for spinal anesthesia, cites three cases of his own In one instance 50 mgm of procaine combined with 10 mgm of pontocaine were used Respiratory failure occurred shortly after injection without change in the blood pressure and pulse In the remaining two cases doses of 35 mgm and 20 mgm of pontocaine, respectively were given In the former, artificial respiration was used for 20 minutes until the respiration, *blood pressure and pulse returned to normal* In the latter, circulatory failure occurred after artificial respiration for 31 hours He then quotes Pfitzner (1931), who reported a series of 85 spinals with pontocaine In the first five, Pfitzner used 5 to 10 mgm of pontocaine in a 0 5 per cent solution with severe *reactions characterized by collapse, pallor, dyspnea and change in pulse rate* In the next 80 cases, Pfitzner used 5 to 8 mgm of pontocaine in 0 25 per cent solution without a reaction

It would appear that Pfitzner, when using even smaller doses than McCluskey employed, had five reactions of a circulatory nature In the remaining cases he changed the dose but slightly, however, he used a more dilute solution which, as we shall show later, slows absorption and so allows detoxification to keep the blood level down It is also possible that the manner of anesthesia used by McCluskey, even with large doses, may have influenced the type of reaction

Shumacker,[18] in a clinical report, cites three nonfatal procaine reactions, two characterized by circulatory collapse, but only one by sudden cessation of respiration and loss of consciousness He concludes that one must suspect that in human beings, as in laboratory animals, the important factor is the rate of absorption and the amount of the anesthetic absorbed, and that upon these factors depend the duration and the character of the reaction

So far, it may be said that the effect is largely central with evidence that peripheral actions can take place On unfirm grounds, it is suggested that peripheral effects may be a function of dose and speed of absorption, or perhaps individual susceptibility The mode of death is respiratory, cardiac, or both It is doubtful that any drug specificity in the mode of death or type of reaction exists[3, 11] Any belief that pontocaine is safer than cocaine from the standpoint of reaction reversibility does not appear to be well founded *Technical Bulletin* 10 A-106, Veterans Administration,[16] states that in pontocaine hydrochloride reactions, patients seldom if ever exhibit prodromal signs or symptoms of anxiety, excitement, or garrulousness This may be due to the fact that a more toxic drug is being used and when a toxic blood level is attained, this phase may be too rapidly passed through to be noted

The types of reaction have been classified by various authors Reactions to overdosages are generally described as mild and severe The severe reactions are then broken down into *1* those with convulsions and a relatively slow course, and *2* those without convulsions, or the rapid collapse type

Some authorities lump idiosyncrasy and allergy under the heading of hypersensitivity Idiosyncrasy or hyperergy (Vaughan[10]) is described as occurring in persons reacting in a normal manner but excessively, as those who sunburn easily At any rate, reaction occurs on occasion to minute amounts of drug, or to less than the quantity needed for anesthesia Reaction is of the rapid or collapse type The underlying mechanism is not clearly understood Obviously, with the present state of our knowledge, little can be done about it Fortunately, it is the least common type of reaction

ALLERGY

Allergic reactions undoubtedly occur Vaughan,[11] in his "Practice of Allergy," distinguishes between hyperergy and allergy In allergy the response is with urticaria, asthma etc Jackson and McReynolds[12] report asthmatic attacks and wheezing occasionally produced by pontocaine Durbes and Engelhardt[13] state that Waldblett (1935) reports urticaria, vasomotor rhinitis and asthma from nupercaine, cocaine and similar anesthetics They further state that allergic shock can occur and that it may occur with what appears to be the first exposure to the drug Allergy in that case is, then, questionable unless one considers the previous use of a chemically related drug as the sensitizing agent They give as examples the phenolic essential amino-acids, including para-amino benzoic acid which is a component of the "B" group of vitamins with a wide distribution in nature In reviewing case reports in the literature, there are many instances noted where reaction was obviously due to overdosage, but surprisingly there were also many cases of allergy supported by positive sensitivity tests Thomas and Fenton[1] performed 201 patch tests using cocaine, pontocaine and controls on patients known to have allergies Less than 0 5 per cent had plus or plus-minus reactions to cocaine Over 9 per cent had plus or plus-minus reactions to pontocaine, and three additional patients had suggestive reactions to pontocaine Four of these tests were later corroborated when clinical reactions to pontocaine developed In all, some 17 cases are reported in the literature as due to pontocaine sensitivity The majority occurred when the drug was used in the eye or were manifested as occupational dermatitis in physicians Allergy is, of course, more obvious when manifested in these forms than as shock

Sensitivity tests are not entirely reliable but apparently have definite value Thomas and Fenton[1] point out that false positive and negative reactions can occur with patch tests, however, patch tests are recommended by them with the foreknowledge that they are not to be regarded as 100 per cent reliable Dr Paul H Moore, in discussing their paper, stated that he believes that the markedly allergic individual should have a patch test before being referred for bronchoscopy Thomas and Fenton[1] then report that mucous membrane tests have been used for aspirin, karaya gum, and sulfonamides A Veterans Administration letter[20] advises that a small amount of pontocaine be applied to a restricted area of mucous membrane preliminary to its use for topical anesthesia In the case reports will be found two cases with positive mucous membrane tests *Bulletin* TB 10 A-106[19] recommends intradermal testing for sensitivity when indicated Doses of 0 1 cc of 1 1,000 solution of pontocaine, cocaine and metycaine are recommended The patient is observed for 30 minutes for wheal formation, including redness and edema Use of the drug giving the least reaction is recommended

ANESTHETIC DEATH DEFINED

With regard to anesthetic deaths in general, the Mayer Report[20] (1924) brings out the following point among those emphasized by the Therapeutic Research Committee of the American Medical Association Dyspnea and the arrest of respiration within a few minutes after the administration of the anesthetic are especially characteristic, so much so that it is questionable whether later deaths can be charged to anesthetics

RELATIVE TOXICITY

Fussgaenger and Schaumann give the relative toxicity based on a value of one for procaine, again on animals and varying with the route of administration, as follows

	Procaine	Cocaine	Pontocaine
Intravenous	1	3	9
Subcutaneous	1	8	20

Clerf and his co-workers[21] have this to say with regard to pontocaine toxicity and potency

"With the increasing employment of tetracaine hydrochloride (pontocaine) it is to be expected that toxic reactions will occur Tetracaine is considered to possess 15 times the anesthetic power of cocaine but is two and one-half times as toxic in the same concentration "

Dr M H Seevers,[22] pharmacologist, of Ann Arbor, Mich, in a symposium on anesthesia at the 1918 meeting of the American Academy of Ophthalmology and Otolaryngology made the following points

1 There are probably more deaths from local anesthetics than from any other single class of compounds in common use today He asked for a show of hands on those who had witnessed a toxic reaction or a death from topical anesthesia during the past five years, and estimated that 30 to 40 per cent of the audience responded

2 In his opinion, cocaine was better than pontocaine for pharyngeal spraying, but cautioned that only a minimum amount be used

3 He also advised that concentrations be reduced and that the less toxic agent be used

DILUTE OR CONCENTRATED SOLUTIONS?

Dr Dean Lierle, in the same symposium, mentioned the advantage of the vasoconstrictive action of cocaine He affirmed that although pontocaine produced an effect of longer duration, this was not vital in the average otolaryngologic procedure Sollmann has this to say regarding the duration of action of local anesthetics, "The duration depends more on concentration than on the total amount of agent, so that it is more economical to use small quantities in high concentration"

As Lierle pointed out, however, long duration is not relevant Later in the text, Sollmann makes a statement which on first glance seems contradictory unless one keeps in mind that the objectives are duration of action in the preceding statement, and rate of absorption in the following statement "Dilution slows the absorption of cocaine and insures its thorough utilization and this economizes its use" This is an important distinction because, as found in our survey of current opinion, the majority feel that concentrated solutions of cocaine retard absorption more than dilute solutions because of their stronger vasoconstrictive action This distinction is significant because the more dilute the solution used, the danger of toxic reaction from overdosage is by just that much reduced There is another consideration in favor of dilute solutions which will be discussed under comments

Shumacker found that experimental animals tolerate slightly larger amounts of procaine, if given in dilute solutions, probably because the larger amounts of the more dilute solutions are more slowly absorbed.

TOTAL SAFE DOSE

The following recommendations are made by the Therapeutic Research Committee of the American Medical Association in the Mayer Report (1924), which is quoted by Sollmann and others. The total quantity of cocaine should not exceed 0.06 to 0.1 gm. (1-1½ gr.). This amounts to 0.6 to 0.9 cc. of 10 per cent cocaine. This is not the dose recommended for actual use, but the dose which their accumulated information indicates is a safe one. It would seem, then, that the total dose which most closely approaches this figure and yet provides efficient anesthesia is the ideal one.

Sollmann, quoting Watson and Williams (1924), states that the ordinary fatal dose of cocaine is 1.2 gm. This is equivalent to 10.8 cc. of 10 per cent cocaine. *Bulletin* TB 10 A-106 of the Veterans Administration states that in effect the concentration of cocaine for anesthesia should not exceed 10 per cent (1 per cent for pontocaine) and that the total fluid employed should not exceed 10 cc. Correspondence regarding this point brought the reply that the 10 cc. solution of either cocaine or pontocaine referred to the total quantity into which pledgets were dipped and not to the quantity which might actually be absorbed by the tissues contacted. (The *Bulletin* recommends only the technique of pyriform fossa applications and states that neither drug be used in the form of a spray.) This still appears to be a dangerous statement and was so judged in our survey.

Sollmann further remarks that death has been reported from 0.02 gm., or the equivalent of 0.2 cc. of 10 per cent cocaine. This, of course, represents an idiosyncrasy. Regarding cocaine solutions, Sollmann states that they should be freshly made and that they can safely be boiled for a few minutes At the Mayo Clinic cocaine solutions are made up for each day's use

The Mayer Report concluded that topical anesthesia with cocaine can be accomplished without danger by the use of carefully measured amounts of solution of low concentration and that all doses of local anesthetics, however applied, should be measured accurately

CHOICE OF DRUG – PONTOCAINE OR COCAINE?

The question now arises, "Is there sufficient evidence to warrant making a definite choice between cocaine and pontocaine?" They are by far the most commonly used topical anesthetics in endoscopy today I believe that cocaine is the drug of choice Sollmann states, and I quote

"Cocaine is satisfactory from the standpoint of efficiency, penetration and practical absence of tissue injury Its rather high toxicity has led to the use of substitutes Some of these present advantages in special fields, although they lack the general applicability of cocaine"

Pontocaine, although cheaper, is more toxic Adriani,[2] as does Seevers, advised the use of the least posible amount of the weakest solution of the least toxic drug Adriani points out that an error of 1 mgm in estimating the dosage of pontocaine is comparable to an error of 10 to 15 mgm of procaine. Cocaine is intermediate here Sollmann emphasizes the fact that *a large proportion of accidents are due to mistakes in drugs, concentrations and dosage*

Allergy to pontocaine appears to be more common than allergy to cocaine

Pontocaine is more irritating than cocaine

Evidence that the mechanism of reaction and death from pontocaine is respiratory only, with the implication of easier reversibility than the ascribed cardiac effect of cocaine, is not impressive

Further evidence is gleaned from the more recent literature Whalen,[23] in 1944, reported on the increasing number of serious pontocaine reactions Thomas and Fenton,[1] in 1943, reported seven cases of pontocaine reaction with three deaths They state that the use of pontocaine has been discontinued in the Cleveland Clinic

Dr Paul H Moore, in the discussion of the Thomas and Fenton paper, remarked that he had used 2 per cent pontocaine excluusively in endoscopy for six years before he encountered a reaction, and this was a fatality Within a two-month period thereafter he had two more reactions, one almost fatal Cocaine was then used without incident, but the period of its use and the comparative number of cases were not given Doane and Cohn[24] (1945) and Ahroon[25] (1946) report deaths from pontocaine Two other articles and our cases reporting reactions are not admissible as both pontocaine and cocaine were used The paper by King and Jones[26] (1948) is commendable for their faithful reporting and for the fact that they have abandoned pontocaine and now use cocaine in a 4 per cent solution for a maximum total dose of 0 16 gm or 2 4 gr Their technique embodying use of a relatively weak cocaine solution in a dose approaching the Mayer Report recommendation is a step in the right direction Jackson and McReynolds[12] list several objectionable features of pontocaine and have this to say about cocaine

> "Cocaine is admittedly the most universally efficacious of the drugs used for local anesthesia and, if used with care, serious reaction will be rare"

PREOPERATIVE MEDICATION AND TREATMENT OF UNTOWARD REACTIONS

The rôle of morphine has been discussed In summary, it is indicated as a preoperative sedative in a relatively small dose, which outweighs any effect on respiratory depression which may occur in a later developing toxic reaction Once a toxic reaction has occurred, it is contraindicated because of its respiratory depression effect Adrenalin is also contra-indicated in nonallergic toxic reactions

Barbiturates are of some value in prophylaxis of the convulsive manifestations only, they are certainly not specific Seevers points out that anyone who believes that barbiturates are protective against serious toxicities *in prescribed doses* is in “a fool's paradise ”

Shumacker, in controlled animal experiments, reports his results with coramine and metrazol in the treatment of toxic reactions Both proved ineffective They were administered intravenously to animals having previously received a lethal dose of procaine For each drug the dosage given was that found to be the maximum safe dose as determined by control studies

As the survey below will reveal, the mean preoperative routine favored is 1½ to 3 gr of nembutal two hours before operation, and morphine, gr one-sixth, and atropine, gr 1/150, one hour before operation

There are two main objectives in the treatment of an untoward reaction One is directed toward the control of convulsive manifestations The second is the maintenance of adequate respiratory and cardiovascular functions The following is copied verbatim from the *Technical Bulletin* 10 A-106 of the Veterans Administration[16] and outlines the treatment of untoward reactions recommended

“*a* In the presence of untoward reaction exhibited by pallor, cyanosis or thready pulse, administer oxygen

“*b* In the presence of muscular twitchings, discontinue the instrumentation and administer oxygen by intermittent positive pressure If the twitchings continue, administer pentothal sodium, 2 to 3 cc , intravenously, being careful to maintain a patent airway

“*1* Having produced muscular relaxation, continue resuscitation by means of intermittent positive pressure with oxygen, keep needle in vein and administer additional pentothal sodium as required to control muscular spasms

"*2* It is futile, in the presence of frank convulsions, to inflate the patient's lungs by administration of oxygen by intermittent positive pressure on the breathing bag The first requisite is to produce muscular relaxation by the administration of pentothal sodium which in turn will permit movement of the chest Only sufficient pentothal sodium should be employed to control the convulsions Oxygen may then be effectively administered if the airway is kept patent either by endotracheal tube or by tracheotomy Do *not* administer adrenalin chloride or ephedrine sulfate in the presence of an untoward reaction to cocaine hydrochloride or pontocaine hydrochloride The combination may produce ventricular fibrillation

'*c* In the presence of a continued low systolic blood pressure, administer fluids intravenously normal saline, glucose in 5 per cent concentration, plasma or blood as indicated Continue treatment with pentothal sodium, inhalation therapy with oxygen and administration of supportive fluids intravenously until the cocaine hydrochloride or the pontocaine hydrochloride has been detoxified Keep the patient under observation until he recovers from the effects of the pentothal sodium"

The following equipment should always be available, and this list also is taken largely from the same *Bulletin*[16]

1 Oxygen with mask and bag for the purpose of inflating the lungs (closed system)

2 A syringe of 20 cc capacity containing pentothal sodium in 2 5 per cent solution

3 Moser life-saving tubes or Magill endotracheal tubes (with metal bite) of the proper size

4 Laryngoscope for tube insertion

5 Tracheotomy set

6 Pharyngeal airway, preferably of Guedel type

Anesthesiologists generally recommend pentothal sodium for the control of convulsions Laryngospasm may develop, however, and it is for this reason that means for maintaining a laryngeal airway must be on hand For the same reason, when pentothal sodium alone or combined with curare is employed for general anesthesia, preliminary topical anesthesia of the larynx is recommended to minimize the complication of laryngospasm

SURVEY OF MEMBERSHIP OF THE AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION SALIENT FEATURES

In July of 1948, questionnaires were sent out to the members of the Association Sixty-five were completed Most of the points covered in the previous review and discussion were included Some of the salient features are listed below In 1940, Jackson and McReynolds[12] reported a survey of the same organization and the results will be compared where feasible

Status of preliminary pharyngeal spraying

Forty-four felt that it should be used for reasons of efficiency and/or relative safety Eighteen considered it unnecessary or unsafe, and of these, 13 considered it unnecessary, two unsafe, and three did not distinguish or felt that it was both unsafe and unnecessary

Status of "cross-action" forceps or applicators with swabs applied to the pyriform sinuses as a preliminary measure

The question was stated so as to bring out a comparison with pharyngeal and aditus laryngis spraying Forty-one considered the pyriform technique more effective, safer or both Twelve considered it more effective, 10 safer, and 19 both, 26 considered the pyriform technique less effective, less safe, or both Of these, 15 considered it less effective, three less safe, and eight both There was some overlapping in that eight used both methods at the same sitting The consensus was, then, 44 in favor of pharyngeal spraying and 41 for the pyriform technique In the 1940 survey the results were approximately the same, however, in our survey only 18 considered the spray unnecessary or unsafe, whereas 26 considered the pyriform technique less effective or less safe

Choice of drugs

This was broken down in the questionnaire to differentiate for the spray, pyriform technique and intralaryngeal instillation

For the spray technique, pontocaine was favored over cocaine, 29 to 19 Butyn and nupercaine received one vote each Of the pontocaine users, the majority, 19, used the 2 per cent solution with 1 to 3 cc as the favored amounts One-half cc was the least amount used and 5 cc the most For cocaine, the majority, five, favored the 10 per cent solution The mean amount for the 10 per cent solution was 1 25 cc Amounts used varied from two to three bursts for the least, to 1 5 to 5 cc for the most

For the pyriform technique the tables were turned, and cocaine was favored over pontocaine, 36 to 14

For pontocaine the majority, 10, favored the 2 per cent solution with 2 cc the favored amount From 0 5 to 10 cc were quoted For cocaine the strengths varied from 4 to 20 per cent Six favored a 5 per cent solution, eight a 10 per cent solution, and seven a 20 per cent solution For the 5 per cent solution, amounts of from 1 to 15 cc were given For the 10 per cent solution the range was from 2 to 3 drops to 4 cc For the 20 per cent solution, the range was from 0 25 cc to 4 cc It should be mentioned that questions called for a distinction between the usual amount used and the maximum safe amount The answers allowed no useful tabulation on this score

Regardless of the strength used (except for the 20 per cent cocaine users) when the technique was given the most favored was two to three applications in each pyriform sinus of one minute duration each Only one 20 per cent cocaine user listed a technique, he used one to two applications of 20 to 30 seconds' duration each, to each side As an extreme instance, one operator using 10 per cent solution recommends soaked applicators to be held for three minutes on each side

Only one commented on the problem of estimating the amount of solution in contact with the tissues and so made available for absorption, and strangely enough this was in reference to the spray technique

Intralaryngeal instillation

Here again cocaine was favored over pontocaine, 30 to 17 For pontocaine the majority, eight, favored the 2 per cent solution with the mean amount 3 4 cc The range was from 0 5 cc to 10 cc of the 2 per cent solution

The majority of the cocaine users, 11, favored the 10 per cent solution with a mean amount of 2 4 cc The range was from 0 5 cc to 5 cc One 20 per cent user recorded 5 cc as the maximum amount used

In the 1940 survey cocaine was also preferred, the vote was 45 for cocaine as against 17 for pontocaine No figures were given on the basis of a breakdown according to the mode of application

Routine questioning for sensitivity to cocaine, pontocaine, novocaine, etc 41 routinely questioned patients as to previous reactions and 23 did not

Premedication routine

The most commonly mentioned drug was the barbiturate nembutal Only 10 did not recommend the routine use of a barbiturate A few did not use morphine The most favored routine was nembutal, gr 1½-3, two hours before operation, and morphine sulfate, gr 1/6, and atropine sulfate, gr 1/150, one hour before operation In the 1940 survey morphine was the most commonly used drug and 21 did not use barbiturates

Technique of anesthesia for esophagoscopy

Some 40 different answers were tabulated, ranging from no anesthesia to swallowing, gargling, spraying or application with as much as 2 cc of 20 per cent cocaine, or 6 cc of 2 per cent pontocaine, to "GOE in 60 per cent of cases"

Combined topical anesthesia and intravenous pentothal with or without curare received occasional mention

Status of general or intravenous anesthesia

Fourteen did not use it Twelve used pentothal sodium alone Thirteen used pentothal and curare and of these, six mentioned preliminary topical anesthesia Twelve used ether or gas-oxygen-ether In general, it was considered indicated in foreign body work in children and in anatomically difficult or unusual cases It is used occasionally for esophagoscopy or direct laryngoscopy and less often for bronchoscopy

CASE REPORTS

The following seven case reports include one death and six minor reactions, three of these exhibiting allergic manifestations The same preoperative routine was followed for all, namely nembutal, 1½ gr , the night before and two hours before operation, and morphine sulfate, gr 1/6, and atropine, gr 1/150, one hour before operation It was also routine, dating from the third case, that one drop of 2 per cent pontocaine be placed behind the lower lip the morning of operation The anesthetic technique was the same used at this one institution since the tenure of the author began in April 1946, it consisted of spraying the soft palate, pharynx and aditus laryngis mainly with 2 per cent pontocaine spray The amount used was at the time roughly gauged to be a maximum of 2 cc in the more difficult cases

In retrospect, I am under the impression that amounts of 4 cc or more may have been used This will be discussed below under comments Following the pontocaine spray, 1 cc of 10 per cent cocaine was instilled into the larynx under mirror visualization using a syringe and a laryngeal cannula Anesthesia was not carried out, or was incomplete in certain cases as noted in the specific case reports In one instance a reaction occurred after pontocaine spray and before cocaine could be used All cases representing toxic reactions occurred within a period of three months, the last occurring Oct 31, 1946 Two allergic reactions to pontocaine have occurred since this date

Case 1 Miss A. M A. had been bronchoscoped by the same physician April 2 1946 without untoward incident On Aug 6 1946 this patient came into the clinic with routine preparation She was apprehensive and perturbed about possible damage to expensive bridge work The operator was having difficulty exposing the epiglottis when the patient suddenly became rigid and exhibited mild twitchings of the lips hands and toes The pulse and respiration were of good quality throughout Pupils were not dilated No cyanosis or skin pallor developed After several minutes all twitchings ceased and no further manipulation was attempted No specific treatment was necessary

Case 2 Mr J L F came in with routine preparation Aug 8 1946 After routine use of pontocaine spray and before any cocaine could be instilled the patient seemed unable to grasp his tongue He tried several times using his right hand, and then developed a tonic spasm of the right upper extremity, followed by clonic convulsions of the face and all four extremities There were no psychical phenomena Respirations and pulse were of good quality pupils undilated and there was no cyanosis or pallor After a minute the patient relaxed and was returned to the ward without operation or special therapy

Case 3 Mr N N P came in for bronchoscopy Oct. 15 1946 He was cheerful and rational to the instant of reaction Preoperative medication and anesthesia were routine as to amounts of drug used and technique As the last of the cocaine was dropped between the cords the patient had difficulty holding on to his tongue He appeared panicky and attempted to rise from his chair but fell back and immediately developed violent generalized convulsions Respirations were stertorous and the pulse could not be obtained at the wrist. An attempt was made to inject sodium amytal into an antecubital vein but the veins were collapsed and the arms in violent motion One cc of 1 1 000 adrenalin was injected into the heart the patient placed on a litter and intranasal oxygen started pending the arrival of a resuscitation apparatus with positive pressure oxygen bag and mask This arrived shortly and artificial respiration was maintained for a considerable length of time after the heart could no longer be heard to beat. Death appeared to be due to respiratory and cardiac failure It was not determined which appeared to fail first Autopsy showed no cause of death

Case 4 Mr J S reported to the clinic for bronchoscopy Oct 18 1946 Preoperative medication and anesthesia were routine After bronchoscopy had been completed uneventfully the patient sat up and developed stertorous respirations with slight cyanosis and thready pulse Mild clonic twitchings of the extremities were noted Sodium amytal in a dose of 3¾ gr was slowly administered intravenously as oxygen was given by nasal catheter Pulse, color and respirations returned to normal within a few minutes

Case 5 Mr L B O had been previously bronchoscoped five times using the same drugs and technique On Oct 31, 1946, he came in and examination of the record shows no notation as to whether the mucous membrane test was positive or not After the patient was placed on the table a macular rash was noted on the chest and upper extremities and there was slight twitching at the angles of the mouth Pulse and respiration were of good quality throughout Twitchings ceased on administration of sodium amytal No operation was performed This would appear to be a drug reaction of allergic character

Case 6 Mr C C came to the clinic in a stupor, May 6, 1947 Preoperative medication was routine Pulse (rate 100), respirations, and skin color were normal Both axilla were reddened and appeared mottled The mucosa behind the lower lip was reddened Bronchoscopy was then performed uneventfully without topical anesthesia This is definitely a case of pontocaine allergy

Case 7 Mr X came into the clinic for a bronchogram Before anesthesia was started, the mucosa behind the lower lip was not checked After one squirt of 2 per cent pontocaine on the soft palate the patient s eyes rolled up and he appeared about to faint The lower lip was pulled back, disclosing a markedly reddened mucosa The patient volunteered the information that this area was "burning" Sodium amytal was given intravenously and 15 minutes later anesthesia was cautiously resumed using cocaine alone, without incident This again, is without doubt a case of pontocaine allergy

Three of the reactions are evidently due to pontocaine alone As pontocaine and cocaine were both used in the others, the causative drug cannot be identified Two of the reactions were due to proven pontocaine allergy and one to a drug allergy, probably pontocaine

COMMENT

In view of the preceding material gleaned from the literature, and in the light of the recent survey and my experience, the drugs and technique used *for topical anesthesia* were modified or changed From our results, I concluded that we had an efficient anesthesia in pontocaine spray combined with cocaine intralaryngeal instillation, however, I realized that we did not have a safe anesthesia and it is in this regard that my interest in topical anesthesia was developed My aim was to find the least amount of the most reasonably dilute solution of the least toxic drug compatible with efficient topical anesthesia for endoscopy

From April, 1946, to March, 1949, 3,609 anesthesias for endoscopic procedures, laryngeal cauteries, bronchograms, etc., were carried out In the first 2,715 cases we used 2 per cent pontocaine spray followed by 10 per cent cocaine (1 cc) instillation It had been our practice to spray the aditus laryngis until the patient could be seen to inhale and exhale spray vapor, indicating relaxation of the protective pharyngeal and aditus reflexes Then 1 cc of 10 per cent cocaine was instilled into the larynx fractionally in a speed depending on the tolerance of the patient The number of spray bursts in an average case was counted and on repeating the procedure in a measuring glass I estimated that we were using a maximum of 2 cc of 2 per cent pontocaine as a spray

As the series of reactions developed from August to October, 1946, the spray was used more cautiously Our patients were instructed not to swallow during the spraying, but to inhale the vapor and to expectorate at the conclusion of each series of spray bursts Less compression on the atomizer bulb was used in order to reduce the amount of solution delivered This served to prolong the procedure and to slow the absorption to allow detoxification to take place, and also made the most of each drop of solution The interval between the spray and the laryngeal instillation was lengthened, usually by spraying one patient, then spraying a second patient, and then returning to the first for the laryngeal instillation

In the meantime, a series of 299 anesthesias was run by the author using the cross-action applicators in the pyriform sinuses and followed this with the laryngeal instillation Ten per cent cocaine was used throughout One dram of cocaine was used to dip the cotton wrapped applicators into, the cotton was squeezed out and held in each pyriform sinus one minute for two applications Then 1 cc of 10 per cent cocaine was instilled into the larynx fractionally A total of 5 cc of 10 per cent cocaine was used, which amounts to 0 56 gm (8 35 gr) The safe dose as recommended by the Mayer Committee is 0 1 gm (1 5 gr)

This technique gave satisfactory anesthesia in the average case, but, in comparison with the spray technique, was found wanting in several respects In the first place, it is more disagreeable to the patient, especially the initiate Deep pharyngeal contact is made from the start and held for one minute It takes a considerable amount of cooperative effort on the part of the patient Second, it is trying on the anesthetist and much vocal persuasive effort is required with a good percentage of patients Occasionally an inured patient prefers this method because "the effect wears off sooner" Third, the total amount of drug employed is much more than in the spray technique True, not all the *drug is available for* absorption, but similarly, in the spray technique, a portion of the amount used is exhaled as visible vapor and a portion expectorated The total amount of drug used must be considered in either case In our experience, it was necessary to instill additional anesthetic agent on the table with the pyriform technique more often than with the spray technique Jackson and McReynolds[12] are also of the conviction that the spray is preferable for two reasons first, it is much less disagreeable, second, it is more efficacious The pyriform technique was, therefore, abandoned

Improvement in the spray technique was then sought To determine the exact amount of drug made available for absorption in the average efficiently anesthetized case was the next step Six atomizers were used three had new bulbs and three had bulbs which had already been in use for variable periods of time A lay member of the clinic personnel was asked to compress the bulb evenly and count the number of squirts needed to fill a measuring glass to the two drams mark The results are tabulated below

Atomizer No 1—New bulb	64 bursts
Atomizer No 2—New bulb	86 bursts
Atomizer No 3—New bulb	93 bursts
Atomizer No 4—Old bulb	80 bursts
Atomizer No 5—Old bulb	120 bursts
Atomizer No 6—Old bulb	163 bursts

It would appear that this method of estimating the amounts of spray solution is highly inaccurate

By trial and comparison, a 2 per cent cocaine spray followed by the instillation of 2 cc of 5 per cent cocaine (1 cc of 10 per cent cocaine was used initially) became the treatment of choice In all, 594 cases were done with this technique to date By careful attention to minutiae satisfactory relaxation of the pharyngeal and aditus laryngis reflexes in the average patient with 2 cc of 2 per cent cocaine spray was obtained

The amount used has been checked by filling the atomizer with a measured amount of solution, then, after each spraying, the amount remaining is accurately measured In this way I know exactly how much cocaine has been made available for absorption in over 100 cases to date These figures also show that adequate relaxation can be obtained with 2 cc of 2 per cent cocaine in the average patient The average amount was 2 3 cc for all cases

In looking back to the period when the series of reactions was taking place, frequently as much as 4 cc of 2 per cent pontocaine and often a larger amount was used, for I was then less cautious

The following details of technique are considered important Only four to six weak bursts are directed against the posterior pharyngeal wall The atomizer tip is then angled to 40 or 90 degrees, depending upon the position of the epiglottis with the tongue held With mirror control, subsequent weak bursts are directed into the aditus, avoiding direct contact of the atomizer tip with the posterior surface of the epiglottis and pharynx As the reflexes relax, the glottis comes easily into view and the spray is discontinued In apprehensive, sensitive patients as much as 3 or 4 cc will be needed for relaxation The advantage of using a solution as dilute as 2 per cent is that even in refractory cases, the total amount of cocaine base is less than if solutions of 4 to 10 per cent are used Occasionally a patient will allow direct instillation with little preliminary spraying, but the active pharyngeal reflex may make adequate exposure of the glottis difficult on the table

We have found that 2 cc of 5 per cent cocaine instilled into the larynx drop by drop, avoiding, especially early, direct contact of the laryngeal cannula with the epiglottis will allow at least the last 0 5 cc of solution to be instilled with no or with a minimum of coughing or restraining effort on the part of the patient

By means of this technique very satisfactory anesthesia with a total of 0 16 gm (2 34 gr) of cocaine was obtained In the occasional case in which as much as 4 cc of 2 per cent cocaine spray is needed, the total dose then becomes 0 2 gm (3 gr) of cocaine With the pyriform technique we used 0 56 gm An ideal atomizer for pharyngeal spraying would be one of 4 cc capacity with 0 5 cc markings

I feel that I have approached the safe dose recommended by the Mayer Committee without sacrificing efficiency The total amount of drug used, which is the determining factor in safety, has been held to a minimum by using dilute solutions and by attention to minutiae of technique, making every drop count In spraying the pharynx and in instilling into the larynx, fractional application is followed, the slower the safer

SUMMARY

1 The controlling factors in the development of toxic reactions are total dosage of drug and the length of time consumed in applying that dose Safety can best be attained by using the least amount of the most dilute solution of the least toxic drug compatible with efficient anesthesia

2 Cocaine is the drug of choice Pontocaine has acquired a certain popularity It was ostensibly developed in the search for a less toxic substitute for cocaine Pontocaine is, however, more toxic than cocaine, a more active allergen, and more locally irritating It is cheaper than cocaine The majority of endoscopists still rely upon cocaine for efficient action where efficiency counts, namely, for direct application to the larynx and tracheobronchial tree

3 A procedure has been presented which in my cases most nearly approaches the ideal for topical anesthesia It is not essentially new, but is as yet not popular through lack of appreciation of the minutiae involved

4 Armamentarium and a procedure for handling of the toxic reaction are recorded

BIBLIOGRAPHY

1 THOMAS, J W and FENTON, M M Pontocaine Fatalities and Constitutional Reactions Following Use *Jour Allergy*, 14 145-159, Jan 1943

2 ADRIANI, J Some Practical Aspects of the Chemistry and Pharmacology of Local Anesthetic Drugs *South Med Jour*, 39 143 149 Feb 1946

3 SOLLMANN, T A Manual of Pharmacology 7th ed Philadelphia W B Saunders Co 1948 pp 262-279

4 GWINN, C D and FERBER E W Relationship of Hydrogen Ion Concentration to Efficiency and Toxicity of Local Anesthetic Solutions *Jour Amer Dent Assn*, 23 1298 1308 July 1936

5 GURD M R. and SACHS, I The Effect of Adrenalin on the Toxicity of Local Anesthetics *Quart Jour Pharmacy and Pharmacology* 12 713-723 Oct Dec, 1939

6 MAYER, E. The Toxic Effects Following the Use of Local Anesthetics, an Analysis of the Reports of Four Deaths Submitted to the Committee for Study of the Effects of Local Anesthetics of the American Medical Association and the Recommendations of the Committee *Jour A M A.*, 82 876-885 Mar 15, 1924

7 FUSSGAENGER, R. and SCHAUMANN, O Ueber ein neues Lokalanaesthetikum der Novokainreihe (Pantokain) *Arch. f exper Path u Pharmakol*, 160 53 65 June 1931

8 DEBBES V J and ENGELHARDT J Deaths Following Use of Local Anesthetics in Transcricoid Therapy Critical Evaluation *Jour Lab and Clin Med*, 29 478-482 May 1944

9 GOLDBERG A. KOSTER, H. and WARSHAW R. Fate of Procaine in Human Body After Subarachnoid Injection *Arch Surg* 46 49-58 Jan 1943

10 GOODMAN L and GILMAN A The Pharmacological Basis of Therapeutics. New York The Macmillan Co 1941

11. DIETRICH, W C and BEUTNER. R. A Search for the Least Irritant Topical Anesthetic *Anesthesiol* 7 255-259 May 1946

12 JACKSON C L. and McREYNOLDS G S JR. Anesthesia for Peroral Endoscopy *Ann Otol Rhinol and Laryngol* 49 1048 1053 Dec. 1940

13 SCHMIDT H Ein neues Lokalanaesthetikum der Novocainreihe (Pantocain) *Chir* 3 97 104 Feb 1931

14. SHUMACKER, H. B., JR.: Reactions to Local Anesthetic Agents. I—Experimental Studies with Procaine. *Surg.*, 10: 119-131, July, 1941.

15. LUNDY, J. S., and ESSEX, H. E.: Experiments with Anesthetics. III—A New Local Anesthetic, Pontocaine, for Prolonged Anesthesia: Laboratory and Clinical Observations. *Proc. Staff Meeting, Mayo Clin.*, 6: 376-380, June 24, 1931.

16. Veterans Administration. *Tech. Bull.*, 10 A-106, Jan. 16, 1948.

17. MCCLUSKEY, C. F.: Pontocaine as a Spinal Anesthetic. *Anesthesia and Analgesia*, 12: 116-118, May-June, 1933.

18. SHUMACKER, H. B., JR.: Reactions to Local Anesthetic Agents. II—A Clinical Report. *Surg.*, 10: 131-141, July, 1941.

19. VAUGHAN, W. T., and BLACK, J. H.: Practice of Allergy. 2nd ed. St. Louis: C. V. Mosby Co., 1948, p. 40.

20. Veterans Administration. Letter from Medical Director, July 6, 1942. Caution in Use of Butyn Sulfate and of Pontocaine.

21. CLERF, L. M., SPENCER, J. T., JR., and RIGGS, C. D., Captain, M.C., U.S.N.: Progress in Otolaryngology: Peroral Endoscopy. *Arch. Otolaryngol.*, 47: 356, Mar., 1948.

22. SIEVERS, M. H.: Symposium: Anesthesia in Otolaryngologic Surgery. *Tran. Amer. Acad. Ophthal. and Otolaryngol.*, pp. 281-323, Mar.-Apr., 1949.

23. WHALEN, E. J.: Anesthesia in Peroral Endoscopy. *Ann. Otol., Rhinol. and Laryngol.*, 53: 169-171, Sept., 1944.

24. DOANE, J. C., and COHN, E. M.: The Toxic Effect of Pontocaine Employed Locally. *Anesthesiol.*, 6: 421-423, July, 1945.

25. AHROON, W. A.: Report of a Death from Pontocaine Hydrochloride. THE LARYNGOSCOPE, 56: 320-323, June, 1946.

26. KING, J. W., and JONES, D. H.: Anesthesia in Endoscopy. THE LARYNGOSCOPE, 58: 1195-1200, Nov., 1948.

AUREOMYCIN IN PENICILLIN-RESISTANT ACUTE OTITIS MEDIA

MARK THUMIM, M D ,
Middletown, Conn

The etiological organism of acute otitis media is almost always sensitive to penicillin The rarity of surgical mastoiditis or chronic purulent otitis media in recent years is evidence of this Because penicillin is effective, most men incise the tympanic membrane and follow it with intramuscular penicillin routinely, however, on occasion one sees a case in which penicillin is not effective In such a case, culture of the discharge should be made and sensitivity to the various antibiotics determined In those cases in which the organism is sensitive to aureomycin, it should be given

CASE REPORT

This patient, a 15-year old white girl reported on March 19 with an acute otitis media A myringotomy was done and 300,000 units of procaine penicillin with 2 per cent aluminum monostearate was given intramuscularly This was followed by similar doses of pencillin on March 21 22, 23 25 28 29 and 31 On each of these days the ear was examined and pulsation of the drum was seen The discharge remained profuse On April 1 the laboratory* reported that culture from discharge collected two days before showed hemolytic staphylococcus aureus (mannitol and coagulase positive) and that it was resistant to greater than four tenths of a unit of penicillin per cc but was sensitive to less than 1 microgram of aureomycin per cc April 2 the patient began to take aureomycin one dose of 500 mg followed at four hour intervals with doses of 250 mg of aureomycin (Patient weighs 122 pounds or 55 kilo) The next day the same procedure was followed April 4 she was examined and discharge was still profuse pulsation of the drum still present The dose was then increased to 500 mg every four hours On the following day April 5 there was a decrease in discharge and on April 6 the canal showed very slight moisture and there was no pulsation of the drum

---

*Thanks are due Dr C E. McLeod for the laboratory work

Editor's Note This ms received in Laryngoscope Office and accepted for publication June 14 1949

Due to the nausea, medication was discontinued for three days When the moisture persisted, aureomycin, 250 mg, was given every four hours and when examined after 18 hours the canal was absolutely dry

DISCUSSION

Before the days of penicillin and the sulfonamides, an acute otitis media which was going on to resolution would drain for from 10 days to three weeks, however, the pulsation of the drum, which is a sign of the severity of the inflammatory lesion, would subside in the first three or four days and the discharge would gradually but definitely lessen after the first week In this patient at the end of two weeks there were no signs of abatement, and within three days after the beginning of aureomycin therapy (a low dosage the first two days), the lesion resolved itself Considering the above, I believe the aureomycin was specific and not coincidental with a spontaneous cure

COMMENT

Since the number of cases of otitis media that are resistant to penicillin are few, I feel justified in reporting one case Culture from cases clinically resistant to penicillin, determination of sensitivity to aureomycin and specific treatment of aureomycin-sensitive cases should corroborate my findings

EPICEREBELLAR SUBDURAL HYGROMA [*][†]

CARL STAMM, M D ,
Philadelphia, Pa

The name "subdural hygroma" was suggested in 1932 by W Dandy to emphasize the basic feature common to all subdural collections of fluids without regard to their etiology

The first observation of such a subdural lesion was made by C H Mayo in 1894 He saw a 12-year-old boy who had hemiplegia and stupor after a head injury Mayo called the released subdural fluid "braincyst" In 1922, E Payr gave a classical description of observations made during the first World War He stated that a sudden traumatic rupture of the arachnoid is the most common cause for the development of collections in the subdural space He also found subdural collections of fluid in head injuries without a rent in the arachnoid He observed three soldiers with tangential head wounds which presented adjacent to the area of the scalp injury, subdural secretions which Payr called "meningitis serosa circumscripta traumatica" He believed that the traumatic pressure from outside was the main factor responsible for the development of those subdural lesions

Streit proved by his experiments that lateral pressure leads to the same reaction in primary inflammatory lesions such as an extradural abscess or lateral sinus thrombosis after mastoiditis The subdural space has poor capacity for absorbing transudates or exudates It does, however, resemble the pleural and peritoneal cavities in the readiness with which it

---

[*] Read at the Medical Staff Meeting on March 22 1949

[†] From the Department of Neurosurgery and Oto-Rhino-Laryngology of the Jewish Hospital Philadelphia Pa

Editor's Note This ms received in Laryngoscope Office and accepted for publication June 15 1949

forms adhesions, the "iron curtain" against invaders These features are also expressed by designations such as protective or sympathetic pachymeningitis circumscripta (H Brunner)

Naftziger was the first American neurosurgeon who published his experiences in subdural collections of fluids (1924) Similar publications followed by Ira Cohen, Walsh, Sheldon, M Scott, DaCosta, Adson and Wycis During the second World War, Adam McConnell and his group, in England, reported on their war observations This study included the largest number of cases observed by any group of examiners In 1945, H Wycis, giving an account on seven personal observations, made a detailed analysis of the 99 cases reported so far in the literature In 33 cases he was able to enumerate the clinical symptoms observed Severe headache was the most common complaint, occurring twice as often as all the other symptoms dizziness, irritability, loss of memory, restlessness, aphasia, hemiparesis and hemiplegia, as well as drowsiness, semicoma and stupor were also noted

It is interesting that Ménière's symptoms were not prominent in the reported cases The following two cases observed at the Jewish Hospital are, therefore, of particular interest

Case 1 A S, a female, white, 39 years old, was admitted on Oct 10, 1946, to the medical ward for observation because of dizziness The patient was discharged on Oct 18, 1946, after a general check up had not revealed evidence of an organic lesion She was readmitted five weeks later, on Nov 25, 1946, to Dr M Scott's neurosurgical service with the diagnosis "Ménière's disease" Her *chief complaint* at that time was vertigo, nausea vomiting buzzing in left ear sensation of pressure in occiput and occasional slight headache This began five months before admission, with dizziness and "funny" feeling in her occiput Severe vomiting began two weeks before readmission and dizziness and nausea were worse whenever she turned her head to the left

Physical Examination Tenderness of left occiput to pressure slightly swaying gait to the left, spontaneous horizontal nystagmus to left, decreased corneal reflex, left, tuning fork lateralized to left ear, mild degree of hearing loss left (10 per cent), slightly increased patellar reflex, left, finger nose test poor, left, slight adiadochokinesis, left, laboratory and Roentgen studies were negative

A cerebellar tumor was suspected and a *suboccipital craniotomy* was performed on Nov 29, 1946 (surgeon Dr M Scott) The exposed left cerebellar dura appeared markedly distended An incision made in the dura released one and one-half ounces of clear fluid No evidence of a cerebellar or cerebellopontine angle tumor was found Biopsy of cerebellar tissue revealed degenerative changes of the Purkinje's cells

The *postoperative course* was satisfactory The patient complained of blurred vision for two weeks after the operation, fundoscopic examination, however, was negative She was discharged from the hospital on Dec 24, 1946 four weeks after the operation in good condition The preoperative symptoms of dizziness, adiodochokinesis and swaying gait had disappeared.

Comment A middle-aged woman developed Meniere-like symptoms over a period of five months At the time of her first admission no organic changes could be found On readmission, five weeks later, definite neurological signs indicating intracranial pressure upon the brain stem, including the left hemicerebellum, were observed A suboccipital craniotomy was performed and a subdural hygroma of the left cerebellar hemisphere was released The patient made a good recovery

The etiologic basis for this hygroma was not demonstrated No history of trauma or mastoid infection could be obtained This, then may be an example of Dandy's idiopathic subdural hygroma due to a local imbalance of proper secretion and resorption of the cerebrospinal fluid

Case 2 J L. white female 36 years old married nurse was admitted to the writer's service on Aug 25, 1948 She was in the Valley Forge Army Hospital for eight months under observation and discharged from service in November 1947 with the diagnosis of 'Ménière's syndrome and migraine' Her present illness began three years before in 1945 with episodes of dizziness nausea and loss of balance Spells returned these attacks lasted a short time and were preceded or accompanied by excruciating headaches radiating from the occiput to the left temple and the left eyeball For the past three months the condition had become worse. Her weight decreased 30 pounds and she suffered from severe insomnia.

In 1937 her left mastoid was operated upon at Womens College Hospital because of chronic ear infection the onset of which started 13 years previously A week after the mastoid surgery the jugular vein was ligated. Drainage from left ear stopped and the mastoid wound closed

Physical examination revealed a thin pale irritable but cooperative patient. There was a well healed left mastoid scar and slight degree of combined deafness left Tuning fork was lateralized to left. Bone conduction was good There was a normal excitability of both labyrinths Spontaneous rotary horizontal nystagmus to left (first degree) could be observed Gait was unsteady swaying to the left. Romberg was positive Patient fell to the left Turning head to right left backward or forward did not change the tendency of swaying to the same (left) side There were typical adiadochokinesis left slightly increased triceps and patellar reflexes left slight hypesthesia of the entire left side and no abdominal skin reflexes left. Laboratory tests revealed increased sedimentation rate (27 and 31 respectively) otherwise negative findings Spinal punc ture showed normal pressure, clear fluid, normal chemistry Pneumoencephalogram demonstrated minimal degree of dilatation of the cortical subarachnoid pathways

A peripheral inflammatory cerebellar lesion was suspected and on Sept 7, 1948, I performed a postauricular left craniotomy Bone covering cerebellum and temporal lobe was very sclerotic and hemorrhagic The dura was markedly distended and reddened Sigmoid sinus was collapsed A large net of distended veins covered the cerebellar and temporal dura A vein crossing Trautmann's triangle was thrombosed The thrombus was removed and in front of this area the dura was punctured About 8 cc of turbid xanthochromic fluid were withdrawn, until the dura collapsed and presented regular pulsation

The fluid withdrawn at operation did not contain any organisms Histological investigation revealed polymorphonuclear leucocytes, occasional lymphocytes and fibrin

Postoperative course was rather stormy, headaches persisted for the first three weeks, but they lost the pounding and boring character For the first week the patient complained of air hunger and weakness of the left leg Three blood transfusions were given In the fourth week she developed a purpura of the lower legs Prothrombin and capillary fragility (Rumpel and Leed) tests were negative Minimal degree of jaundice was present The patient was discharged from the hospital on Oct. 2, 1948, four weeks after the operation She was seen by the writer in his office for the next two months and was discharged in February, 1949 Her gait was normal again, dizziness had disappeared, occasional slight headaches recurred, area of exposed dura was still tender to pressure at the time of her last visit. Patient was advised to return after several months for a check up and a possible plastic repair of the postauricular tender areas

Comment Here, also, a middle-aged woman presented Ménière-like symptoms The history, however, was more complicated A left-sided chronically discharging ear had to be operated upon 11 years ago (1937) A week after mastoidectomy the thrombosed sigmoid sinus was exposed and the jugular vein ligated Eight years later (1945), Ménièriform attacks with severe hemicrania occurred They recurred more often the first year (1946) and incapacitated the patient for work

At the time of admission, the patient presented definite clinical findings characterized by incoordination of posture and motility Romberg test revealed a tendency to fall to the left, the gait was swaying to the left, adiadochokinesis, hypermetria and dysmetria were present on the left side Rotatory-horizontal nystagmus to the left of first degree could be observed These phenomena proved at least a topographical diagnosis, namely, a physiopathology of the left hemicerebellum

Which anatomical changes were responsible for these hypofunctional reactions of the left cerebellum was our next problem. There were several possible lesions *1* Degenerative, due to impaired blood supply, *2* space taking *a* arachnoiditis adhesive serosa, *b* frontal lobe tumor, *c* extracerebellar inflammatory lesion

1 Our first thought focused to possible degenerative changes of the cerebellar centers due to lack of proper blood supply The otological literature recites a number of examples where cerebral accidents occurred after the ligature of the jugular vein in sinus thrombosis (Linser, Bruns, Stolz, Ruttin, Urbantschitsch) M Eisner and D Myers called attention especially to the vulnerability of the left sinus and the left jugular vein, they found that in 75 per cent of their observations on patients, the diameter was much smaller than that of the right side

In the beginning we were inclined to favor a degenerative etiology because of the negative laboratory findings The severe headache, however, increased tendon reflexes and hypesthesia of the left side pointed to a space taking lesion which could be *2* arachnoiditis adhesive serosa (Oppenheim, Pette, Placzek and Krause) of the cisterna lateralis, a condition observed and described by Bárány in several cases after extradural abscess and lateral sinus thrombosis, in tuberculosis and syphilis In some textbooks this specific arachnoiditis is called "Barany's symptom complex." Recently L Fleischmann reported a classical case observed years after a healed radical mastoidectomy It resembles the clinical manifestations of a pontocerebellar tumor The common feature is complete deafness, and a nonreactive homolateral labyrinth is seen in both, a choked disc and a high spinal pressure are often seen in "Barany's disease" Those phenomena were not observed in our patient

3 A tumor of the right frontal lobe could elicit pseudo-Meniere syndromes as seen in our patient The frontal lobe sends impulses to the contralateral cerebellar centers via the frontopontine system and the middle cerebellar peduncle A tumor can impair those impulses and consequently the cerebellum dependent on them (E A Spiegel) Roentgen studies, including pneumoencephalogram, excluded neoplasms Thus "per exclusionem," our conclusion was

4 An extracerebellar inflammatory lesion I contacted Dr Emily L VanLoon, who did the mastoid operation in 1937, she gave me valuable information on her observations made at that time She informed me that a thrombosis of the lower portion of the sigmoid sinus was found, that the septic temperature dropped to normal after the ligature of the jugular vein, that the excruciating headaches of which the patient had complained before the operation were still noticed a long time after the patient was discharged from the hospital This report gave rise to a new question "Was the sinus thrombosis the only otitic complication at that time?" A meningitis serosa often occurs simultaneously with sinus thrombosis, especially in children and young adults (H Brunner) L Hayman could prove the incidence of a pachymeningitis interna after sinus thrombosis had been provoked in experimental studies The meningitis serosa may resolve spontaneously, may localize with formation of adhesions (pachymeningitis serosa interna circumscripta) or may progress, causing a subdural empyema (Preysing) It is possible that the infection went through all these stages in our case The turbid fluid withdrawn from the subdural space contained many leucocytes, but no organisms Apparently immune biological forces had in time overcome the virulence of the infection, had absorbed a portion of the cystic content and left behind what we may call another variety of a "subdural hygroma" While this is probably the sequence of events, it is not possible to exclude the independent occurrence of this lesion seven to eight years later, in 1945, when the patient's severe complaints began A dura exposed by a previous mastoid operation can be very sensitive to reinfection, especially in the presence of marked sclerosis of the temporal bone, indicative of recurrent otitis media

SUMMARY

1 A historical review of "subdural hygroma" is given

2 Two cases of epicerebellar subdural hygroma presenting Meniere-like syndromes are reported The etiology of the first case is unknown, it is presumably an "idiopathic hygroma" (Dandy) In the other case the hygroma developed apparently from a previous subdural empyema as a sequence of severe mastid infection

3 Both patients recovered

4 No reports of Menièriform syndromes due to subdural hygroma were found in the reviewed literature

REFERENCES

1 Adson, A. W See DaCosta, D G

2 Barany, R *Verhandl d Deutsch Otol Gesellschaft,* 108 1912

3 Brunner, H Intracranial Complications of Ear Nose and Throat Chicago Year Book Publishers 1946

4 Bruns, P, and Linser, P *Beit z Klin Chir*, 28 642 1900

5 Cohen, Ira *Arch Neurol and Pysch*, 18 709 1927

6 DaCosta, D G, and Adson, A W *Arch Surg*, 43 559 1941

7 Dandy W E In Lewis Practice of Surgery XII 291 1948, in Kopetzky Surgery of the Nose Nelson & Sons 1947 p 387

8 Ersner, M S and Meyers, D The Laryngoscope 43 800 1933

9 Fleischmann, L *Acta Otolaryngol*, 36 17 1948

10 Haymann, L *Arch f Ohrenh.*, 83 1, 1910

11. Linser, P See Bruns P

12 Mayo C H *N Y Med Jour* 59 434 1894

13 McConnell, A. A. *et al* *Jour Neurol and Psych* 4 237 1941

14 Naftziger, H G *Jour A M A* 82 1751 1924

15 Oppenheim, H and Borchardt M *Deutsch med Wchnschr* 36 57 1910

16 Payr E *Med Klin* 12 84 1916

17 Pette *Ztrlbl f Neurochir*, 112 86 1936

18 Placzek and Krause *Berlin klin Wchnschr*, 44 94 1907

19 Preysing Cited by Bayer H in Operationen am Ohr C Kabitsch Leipzig 1931

20 Ruttin E *Monatsschr f Ohrenh* 53 535 1919 59 177 1925

21. Scott, M *Amer Jour Surg*, 55 534 1942, Surg 13 152 1943

22 Spiegel, E A. Neurology of the Eye Ear Nose and Throat Grune and Stratton, 1944

23 Stolz *Korrespondenzblatt der Schweizer Arzte* No 13 1918

24 Streit H *Arch f Ohrenh* 83 202 1910 89 117 1916

25 Urbantschitsch, E *Monatsschr f Ohrenh*, 52 284 1918, 53 534, 1919

26 Walsh, M N and Sheldon C H *Proc Mayo Clin* 12 134 1937

27 Wycis, H *Jour Neurosurg* 2 340 1945

RATIONAL TREATMENT OF TRACHEAL FOREIGN BODY WITH CASE REPORT *

Harold M Cutler, M D ,
St Louis, Mo

Frequently, in the field of endoscopy the question of diagnosis is perplexing, while the treatment may be obvious There are times when the diagnosis is rather obvious and the treatment a bit perplexing Metallic foreign bodies lend themselves to adequate radiographic visualization The diagnosis, in these cases, is rather obvious

The incidence of open safety pins in the tracheobronchial tree is extremely low Norris, in a recent report of 250 foreign bodies covering a period of five years at Chevalier Jackson *Bronchoscopic Clinic, reports one open safety pin in a* child of two years The incidence of other pointed metallic objects is also low as compared with the vegetal and nonmetallic foreign bodies

The delay in diagnosis or even suspicion of a foreign body is greater with the nonobstructing type It will vary from a few hours to many years As in the case to be reported, symptoms are intermittent and may lead to a diagnosis of severe respiratory infection or pneumonia and treatment be instituted Once suspicion of a foreign body is aroused or a chance X-ray demonstrates it, urgency and emergency ensues The parent can always recall that the child was playing with *the same object or something similar only a* few hours before

CASE REPORT

L C , a 20 month-old white female was admitted to St Louis Children's Hospital about 10 P M , Feb 11, 1919, with a history of apparent health until two days before, when she developed fever, cough, irritability and anorexia The mother recalled seeing the child playing with a safety pin on the day of the onset of the symptoms The cough did not persist, but

---

*Presented as Candidate's Thesis to St Louis Ear Nose and Throat Club

Editor's Note This ms received in Laryngoscope Office and accepted for publication, June 15 1949

the other symptoms did until admission During the afternoon of admission, the child was taken to her family physician and diagnosed as having pneumonia and given 300 000 units of procaine penicillin in sesame oil intramuscularly This same diagnosis had been made on two or three occasions before and the mother was dissatisfied this time The child had then been taken to the station hospital Scott Field Ill where chest Xray demonstrated the presence of an open safety pin in the neck She was then referred to this hospital for treatment.

Family history was noncontributory Past history was noncontributory except that the child had had measles and whooping cough at the age of six months followed by virus pneumonia every one to two months since that time treated by intramuscular penicillin At the age of six months the child lost her voice suddenly one night. This was followed by crying and facial grimaces Aphonia persisted for two days when the voice gradually returned to a weaker and more hoarse type than previously

Physical examination was essentially negative except for coarse breath sounds with moist rales throughout. Fluoroscopy showed an open safety pin minus the keeper points up in the trachea. There was slight haziness in the right upper lobe The mediastinum was in the midline

Xray Report An open safety pin is visualized lying in the trachea at the level of the first thoracic vertebra ' Admission laboratory work showed a white count of 19 200 with a moderate shift to the left. Urine was entirely negative Examination of the vocal cords by direct laryngoscopy revealed redness and thickening of the posterior ends of the cords and the interarytenoid space The airway was adequate and the foreign body was not visualized

Because of the position of the foreign body the age of the child and the fact that two points had to be brought through the glottic chink it was deemed advisable to do a tracheotomy and remove the foreign body through the tracheotomy wound under local 1 per cent procaine anesthesia and three-fourths of a grain of sodium phenobarbital intramuscularly Upon opening the trachea no evidence of the foreign body was seen A 5 mm. bronchoscope was then passed through the tracheotomy wound to the region of the carina without the foreign body being seen The direction of the bronchoscope was then reversed and the spring of the pin was identified just below the glottis This was grasped and removed without difficulty points trailing A No 2 tracheotomy tube was inserted the wound was partially closed with silk sutures to the skin and the patient was returned to the ward in good condition.

Twelve hours later the tracheotomy tube was blocked off without evidence of respiratory distress The tube was removed the following day Secondary closure of the wound was made two days later The child received a total dosage of crystalline penicillin intramuscularly 240 000 units daily and streptomycin subcutaneously 600 000 units daily for a period of seven days The admission temperature was 37 3° C It rose to 38.5° C 12 hours following the removal of the foreign body and then returned to normal where it has remained ever since

Direct laryngoscopy by means of a Flagg laryngoscope was carried out on the fourth postoperative day The cords were of normal color the thickening and redness had subsided but there was still some thickening in the interarytenoid area The voice continued to improve and by the time the child was discharged from the hospital, on Feb 24 the voice was of normal timbre Physical examination was entirely normal the wound was healing well and no sequelae were anticipated

DISCUSSION

In this case we were confronted with an open safety pin, point up, minus the keeper The problem of removing a double pointed object through the larynx brought to mind many possible complications The logical instrument seemed to be a safety pin closer in order to draw the points safely into the bronchoscope The lack of a keeper made the disengaging of the pin with its subsequent loss a possibility We felt that the larynx would admit a 4 mm bronchoscope and several minutes might be required to accomplish the maneuver of bringing the pin safely into the scope This would have had to be done with great care to prevent damage to the cricoid cartilage, with its possible resultant stricture formation Damage to the vocal cords was to be avoided Safety pins are also quite elusive In attempting to remove them in the tracheobronchial tree, one frequently hears or reads of them going from one bronchus to the other

In this case, the point seemed embedded in the region below the interarytenoid space and well fixed Radiographic studies demonstrated it extending from the fifth to the seventh cervical vertebrae It seemed logical to remove this through a tracheotomy opening as the most expedient and safest method

An elective tracheotomy is a simple, safe procedure The resulting scar is negligible A potentially dangerous foreign body from the standpoint of manipulative trauma, damage to the cricoid or vocal cords, certainly lends itself to a simple, safe tracheotomy with removal of the foreign body through the tracheotomy wound

Radiographic studies can be, and often are, misleading Size and position of the foreign body can be easily distorted by the positioning of the tube in relation to the part to be examined and the film The film demonstrated a rather large safety pin, lying low in the trachea We expected to encounter the pin in the tracheotomy opening When the pin was not seen in the wound, a 5 mm bronchoscope was passed to the region of the carina without visualization of the foreign body It was then directed toward the larynx, the pin visualized and removed with the points trailing The pin was small in size, as compared with the expected size from the film It was corroded to the point of marked weakness in several areas

Upon seeing the pin, the mother noted that it was not the pin the child had played with two days prior to admission We feel safe in assuming that this foreign body was present some 14 months Perhaps the keeper had separated because of corrosion and pressure and may have been coughed out The appearance of the vocal cords, the history of hoarseness with return to normal voice following removal of the foreign body seems to substantiate this belief

In retrospect, it is felt that an attempt at removal by bronchoscopy would have resulted in the fragmenting of the pin with subsequent lodging of portions in the smaller bronchi

SUMMARY

1 A case of double-pointed foreign body (open safety pin minus keeper) of trachea is presented with removal through tracheotomy wound

2 A significant delay in diagnosis is postulated

3 Radiographic studies may be misleading unless perfectly spotted

REFERENCES

1 Norris Charles M Foreign Bodies in the Air and Food Passages a Series of 250 cases *Ann Otol, Rhinol and Laryngol* 57 1049 1071 1948

2 Clerf, Louis H Foreign Bodies in the Air and Food Passages Observation on End Results in a Series of 950 Cases *Surg Gynec and Obst.*, 70 328-339 1940

3 Jackson, C., and Jackson, C L Disease of the Air and Food Passages of Foreign Body Origin. New York W B Saunders Co 1936

4 Jackson C L Endoscopy for Foreign Body *Ann Otol Rhinol and Laryngol* 45 644 654, 1936

5 Jackson, C L Bones as Overlooked Foreign Bodies in the Lung *Arch Otolaryngol* 12 499 507 1930

6 Jackson C and Jackson C L Foreign Bodies in the Air and Food Passages Roentgenologically Considered New York Paul B Hueber Inc Ann Roentgen Vol 16 1934

3720 Washington

ABSCESSES OF THE RETROPHARYNGEAL SPACES IN ADULTS *†

MORRIS DAVIDSON, M D ,
St Louis, Mo

Abscesses of the retropharyngeal spaces occurring in infants and children have literally been reported by the hundreds In 1909, Vas[1] described 1,054 such abscesses in patients at Children's Hospital in Budapest In contrast to the incidence in infants and children, their relatively infrequent occurrence in adults is apparent from a review of the literature Watson,[2] in 1903, presented one in an adult that he had seen in his years of practice and was able to find in the literature only 16 previously reported for adults

To date, a review of the literature reveals that 114 abscesses of the retropharyngeal spaces in adults have appeared in medical reports

To these, I am adding six gathered from the records of Barnes Hospital in St Louis, Mo , from January, 1932, to January, 1943 In addition, I am including two I saw recently, both occurring within a period of six weeks

Faier[3] reported seven adults with abscesses in the retropharyngeal spaces in 81,986 admissions to Barnes Hospital from December, 1914, to January, 1932, or once in 11,712 admissions The present series of six occurred in 69,956 adult admissions to Barnes Hospital from January, 1932, to January, 1943, or one in 11,659 adult admissions

---

*Submitted as Candidate's Thesis to the St Louis Ear Nose and Throat Club

†From the Department of Otolaryngology Washington University School of Medicine St. Louis Mo

Editor's Note This ms received in Laryngoscope Office and accepted for publication June 1 1949

The rarity of this condition in adults as indicated by the paucity of clinical reports is not consistent with the records at Barnes Hospital, since 13 of the 122 cases occurred in this hospital alone

HISTORICAL

Mackenzie[4] cites an abscess of the retropharyngeal space reported in the second century, A D , by Galen with spontaneous rupture No mention was made whether or not this occurred in an adult

The first to be reported in an adult was by Syme,[5] in 1826 This abscess occurred in a 35-year-old male and was probably the result of cervical caries The patient recovered when a large sequestrum was removed from the pharyngeal wound

ANATOMY

The writings of Grodinsky,[6-8] Holyoke,[8] Weintraub,[9-10] Iglauer[11-13] and Proetz[14] have done much to refute the original idea that the area behind the pharynx was one space Some present-day texts persist in this viewpoint.[84-85]

It would be redundant to recite in detail the anatomy of the retropharyngeal spaces as described by the above authors A review of the anatomy of this area reveals four potential spaces behind the pharynx (see Fig 1) The following is a brief account of these spaces

Peripharyngeal Spaces These are paired and intramural, separated in the midline by a vertical, fibrous septum These spaces extend laterally to the neurovascular bundle of the neck with the internal carotid artery as the most medial constituent They extend above to the upper margin of the superior constrictor muscle, and below, the spaces terminate behind the cricoid cartilage

Postvisceral Space This potential space is limited behind by the perimysium of the prevertebral muscles and anteriorly by the fascial layer investing the peripharyngeal space, the postvisceral space extends laterally to the neurovascular bun-

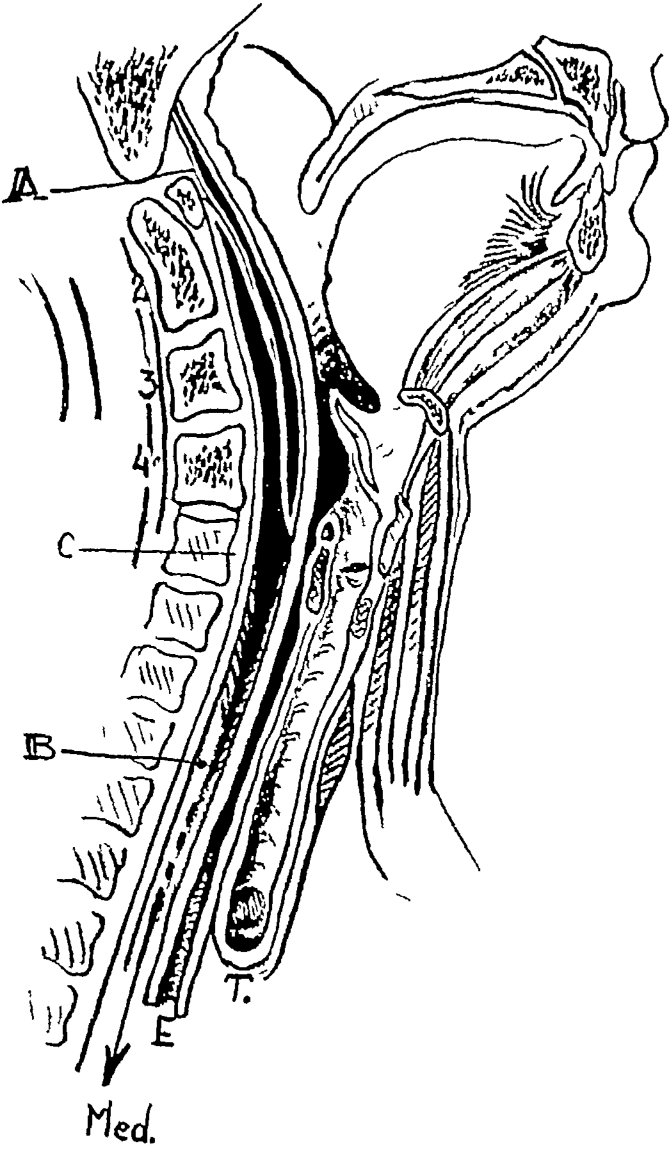


Fig 1 Diagrammatic view* of midsagittal section of the head and neck illustrating retropharyngeal spaces (A) Peripharyngeal space (B) Postvisceral space (C) Prevertebral space

*Drawing made by Dr Jose Bello of Buenos Aires Argentina dle of the neck, superiorly, it ends medially at the tubercle of the arch of the atlas, below, it proceeds through the superior aperture of the thorax behind the esophagus into the posterior mediastinum

Prevertebral Space This potential space exists behind the prevertebral fascia extending from the base of the skull to the coccyx

Iglauer and Weintraub have recommended the elimination of the term "retropharyngeal" They prefer that the space involved be so designated instead of grouping all of the spaces together

Grodinsky and Holyoke[8] stress the obvious importance of a thorough knowledge of the fascia and fascial spaces in anticipating the routes of spread of infection and in planning proper incisions for drainage

Weille,[15] however, feels that splitting the cervical fascia into subdivisions has resulted in overlooking the remarkable ability of the cervical fascia to produce walling off in the presence of any inflammatory stimulus

Lymph nodes are found adherent to the outer coat of the pharynx on each side and situated between the cupola of the peripharyngeal space and the internal carotid artery Most[16] has indicated that these nodes drain the nose, sinuses, nasopharynx, Eustachian tube, middle ear, mastoids, pharynx, tonsils, teeth and larynx

Thomson[1] states that these nodes atrophy after the fifth year Frank[18] and Goldstein[19] believe the atrophy of these nodes accounts for the uncommon occurrence of abscesses in adults

Dense, thick, fibrous bands separate the peripharyngeal from the parapharyngeal space, and the tendency for abscesses in the retropharyngeal spaces to gravitate downward may account for the fact that spread of infection from the peripharyngeal space to the parapharyngeal space has never been reported

PATHOLOGY

A simple peripharyngeal abscess, Iglauer[12] writes, results from the breakdown of infected lateral peripharyngeal lymph nodes which are in intimate topographic relation with the upper *portion of the peripharyngeal* space Infection from these nodes would tend to extend most likely into the peripharyngeal space From a study of the cases reviewed, one is unable to gather any definite statistics regarding the incidence of involvement of the spaces behind the pharynx It is assumed that the peripharyngeal space is most often involved This statement is made, however, because of the greater accessibility of the peripharyngeal nodes (Iglauer[11]) to infection and injury

Involvement of the prevertebral space occurs most frequently with involvement of the cervical vertebrae from tuberculosis, injury with osteomyelitis, and syphilis

Grodinsky[7] states that abscesses behind the prevertebral fascia usually gravitate to lower levels along the muscles taking origin from the vertebral column, and he states, further, that there is very little tendency for infection in this space to perforate through the prevertebral fascia into the postvisceral space

Weintraub[10] and Grodinsky[7] have indicated that infection can spread from one space to another and with spread into the postvisceral space will result in invasion of the thorax with mediastinitis

Furstenberg[20] suggests that mediastinitis results from direct extension along fascial planes of the neck or by lymphogenous metastases

From a review of the literature for retropharyngeal abscesses in adults it appears that mediastinitis occurs infrequently as an accompaniment of disease in these spaces In only 10 instances were these abscesses complicated by medastinitis

It has been stated that abscesses in the retropharyngeal spaces may result in spread to the axilla and lateral chest, yet this complication is not noted in the review

In the formation of otogenic pharyngeal abscesses, it is probable that the same disease process that causes the otitis media and mastoiditis results in the destruction and rupture of the peripharyngeal glands with resultant abscess formation

McKenzie,[21] Cunningham[22] and Faier[3] have enumerated possible methods by which otogenic pharyngeal abscesses may be produced

McKenzie

1 By direct extension of purulent disease from middle ear through the petrous bone to the pharynx

2 By wandering of an extradural abscess of the middle cranial fossa to the tip of the petrous bone and then by the foramen lacerum to the extracranial inferior surface of that bone

3 By direct extension of purulent disease from pneumatic cells in the tympanomastoid osseous structures to the under surface of the occiput and then to the pharynx

4 By wandering of an extradural abscess of the postcranial fossa to the suboccipital region

Cunningham

1 Infection of a retropharyngeal lymph node

2 Direct extension forward of a middle ear suppuration

3 Direct extension from a necrotic area in the mastoid process

4 Exit of an extradural abscess from the cranial cavity

5 Secondary burrowing of a Bezold's abscess

He concludes that in retropharyngeal abscess the ear warrants investigation in every case

Farer

1. Propagation of infection by continuity of lesions of bone, labyrinthine cellulitis, etc
2. Preformed nerve and vessel channels, and embryonic structures
3. Lymphatic pathways
4. Venous pathways

It is likely that infection is introduced when an abscess is the result of a foreign body The extent of involvement depends upon the depth of penetration of the foreign body

Abscesses of the retropharyngeal spaces in the cases reviewed occurred in 49 males and 23 females The reason for this unusual frequency in males is unknown

ETIOLOGY

Some confusion exists as to the most common etiologic factor in abscesses of the retropharyngeal spaces in adults

Rimer[23] believes that most abscesses in the retropharyngeal spaces are due to acute upper respiratory infection Smith[24] feels that influenza with severe nasopharyngitis and rhinitis is the most common cause

Christierson[25] states that tuberculosis of the cervical vertebrae is the most frequently encountered cause

While several texts indicate foreign bodies as a common cause, Tucker[26] has indicated that a foreign body complicated by an abscess in the retropharyngeal spaces is rare

According to Barbour,[27] abscesses rarely occur in adults because of the immunity acquired from frequent submarginal infections which children have not acquired

In an unusual case reported by Kistler,[28] the patient developed an abscess after a self-attempted passage of a stomach tube to relieve esophageal stenosis

In another unusual case reported by Laszlo,[29] a patient developed an abscess after an injury to the back of his neck with fracture of the third cervical vertebra, resulting in osteomyelitis of that vertebra

Sheedy[30] lists abscesses of the sphenoidal sinuses as one of the causes of abscesses of the retropharyngeal spaces, however, the literature makes no mention of this condition as a predisposing factor

For the total number of abscesses in the retropharyngeal spaces reported in the literature, 72 are attributed to some etiological factor

Causative factors of abscesses in the retropharyngeal spaces

Upper respiratory infection	21	(37 60 41, 67 74 71, 20, 25—3 cases 3—2 cases 53 7, 46 82, 83 3 Barnes Hospital 1 author)
Otitis and mastoiditis	28	(23 78 76 22—7 cases 18—2 cases 39—2 cases 70 62 80 65—8 cases, 3 Barnes Hospital)
Foreign bodies	7	(7—2 cases 25 26 56 36—2 cases)
Tuberculosis of the spine	6	(25 38 52 40 64 1 author)
Tonsillectomy	4	(77, 75 18—2 cases)
Syphilis	2	(18 12)
Trauma to pharyngeal wall	1	(28)
Injury to neck with osteomyelitis	1	(29)
Dental infection	1	(3)
External otitis with parotitis	1	(3)
Unknown	49	18—5 cases 68—2 cases 47 66 (15—6 cases 2 35 63—6 cases 61 56 79—2 cases 60 59 5 45 44 43 42 24—7 cases 81—4 cases, 32 31—2 cases, 39)

According to Faier,[3] suppurative otitis media is frequently overlooked as an etiologic factor in abscesses of the retropharyngeal spaces and may be of major consequence in the ultimate recovery of the patient if the association is recognized early

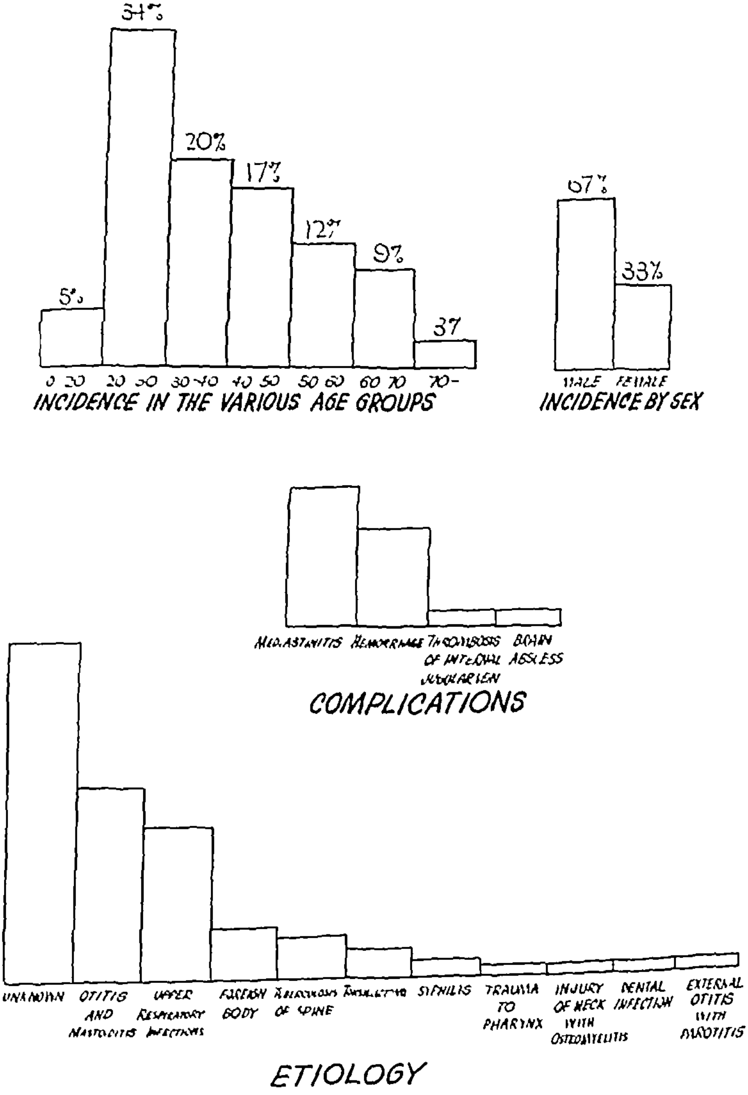


Fig 2

SYMPTOMS

The following symptoms occurred in order of frequency in the cases cited from the literature

Dysphagia
Pain in the throat
Dyspnea
Stiffness of the neck
Difficulty in opening mouth
Loss of weight
Nasal obstruction
Pain in the head, back and arms
Pain in the ear
Hoarseness
Cough

In addition to the above mentioned symptoms, almost all presented signs of toxicity with fever, chills and prostration

DIAGNOSIS

The diagnosis of abscess of the retropharyngeal spaces in adults is usually made quite readily, particularly in acute conditions The history, examination of the patient, palpation of the mass, aspiration of the abscess with a needle and syringe and X-ray studies serve to reveal the true nature of the lesion In the chronic form the abscess may be months in formation before sufficient symptoms occur to require medical attention In one instance of the present series six weeks ensued between the original complaints about the neck and development of sufficient symptoms and signs to require attention

The value of X-ray examination cannot be overemphasized Barlow[31] and Kistler[28] stress the value of X-ray diagnosis Weiller[14] states that lateral X-rays of the neck will make it possible to determine the presence of retroesophageal mediastinal extension

TREATMENT

In the treatment of abscess of the retropharyngeal spaces in adults, some controversy exists as to the proper method of surgical approach

Dean[54] used the external approach and wrote that not only should every case of retropharyngeal abscess which is secondary to caries of the vertebrae be drained externally, but every case of retropharyngeal abscess should be drained in this way Dean advised a vertical incision parallel to the anterior border of the sternocleidomastoid muscle, with finger dissection in the deeper structures until the abscess is reached Lillienthal[55] advised making the incision posterior to the sternocleidomastoid muscle and he used an aspirating needle to indicate the site of the abscess before opening

Kanavel,[51] Smith[24] and Christierson[25] agree that all abscesses as the result of tuberculous caries of the cervical vertebrae should be drained by the external approach, and Kanavel further states that opening tuberculous abscesses through the mouth is a serious technical error, and that the lateral approach should be performed in such a manner as to prevent secondary infection

Burckhardt[56] has reported the persistence of a draining fistula following drainage of an abscess by the external route

Thomson,[17] on the other hand, reserves the external incision for those abscesses too low in position to be reached through the mouth, when spasm of the masseter muscles cannot be overcome, when a large pulsating vessel is noted in front of the abscess and when the abscess is more lateral

In tuberculous involvement of the cervical vertebrae, fixation of the cervical spine is essential to healing according to Christierson[25] Blair[57] informs me that opening an abscess due to tuberculous caries of the cervical vertebrae without adequate fixation of the head and neck may result in serious injury or death, since, in many cases, the abscess acts as a splinting mechanism The sudden release of this splinting may result in loss of vertebral support with spinal cord paralysis and death.

In the series of cases reviewed, 31 were opened through an oral incision and 13 were drained by the external approach Nine of the abscesses ruptured and drained spontaneously

Dixon[58] was the first to advise the use of two suction pumps simultaneously in suctioning off the pus after incision of an abscess through the mouth In Case 1 this procedure was undoubtedly of life-saving value

As regards the treatment of otogenic pharyngeal abscesses, McKenzie[21] advocated cleaning out the diseased mastoid and opening the pharyngeal abscess through the mouth

It is felt that the use of penicillin and streptomycin will play a considerable rôle in these infections In three of the cases presented, penicillin was used, prompt recovery followed draining of the abscesses Streptomycin was used in two of my cases with beneficial results in one, in the other case the patient was moribund when the drug was instituted

It is felt that abscesses of the peripharyngeal space can be adequately treated with incision and drainage through the mouth

Abscesses of the postvisceral space should be approached externally so that the mediastinum may be adequately drained Abscesses of the prevertebral space can be best treated by the external approach to the posterior pharyngeal structures after splinting has been accomplished

SUMMARY

1 Abscesses of the retropharyngeal spaces in adults occur more frequently than reports in the medical literature indicate At Barnes Hospital in St Louis, Mo, during a 29-year period, one case of abscess in approximately 11,700 adult admissions was seen

2 The term "retropharyngeal" should be used only when speaking of all the spaces behind the pharynx Whenever possible, the exact location of the abscess should be indicated The instillation of iodized oil through the pharyngeal incision will frequently help in indicating the extent and site of involvement

3 Abscesses of the retropharyngeal spaces in adults occur more than twice as often in males The reason is unknown

4 These abscesses occur most frequently following upper respiratory infections and following infection in the middle ear and mastoid

5 The symptoms most frequently encountered are Dysphagia, pain in the throat, dyspnea, stiffness of the neck and difficulty in opening the mouth

6 Mediastinitis and massive hemorrhage are the most common complications of this condition Mediastinitis occurred in 10, and massive hemorrhage in seven of the cases reviewed

7 The use of two suction pumps simultaneously in opening abscesses of the mouth is considered essential

Case 1 (see Figs 3, 4, 5) A 23 year old Negro housewife was admitted to the Homer G Phillips Hospital on Dec 6, 1948, with complaints of severe pain in the throat, dysphagia, dyspnea, loss of weight, chills and fever Three weeks before admission, during an acute upper respiratory infection, she developed a sore throat with chills and fever which gradually became worse A week before admission she developed difficulty in swallowing and on admission was able to swallow only liquids In attempting to swallow, she frequently returned much of the liquids through her nose Four days before entry, she developed increasing difficulty in breathing and was forced to sleep in a sitting position There was no history of tuberculosis, trauma or foreign body

She has had frequent "head colds" during the winter with occasional sore throats The left side of her face and neck was severely burned in a fire in 1934

The physical examination revealed the patient to be well developed and fairly well nourished She was in marked distress She spoke with much difficulty and the mouth and pharynx were examined with considerable difficulty because of pain associated with opening the mouth Breathing was difficult and she was unable to move the head or neck without pain

Fig. 3 Lateral view of the neck showing massive soft tissue swelling

The tonsils were red and small The posterior pharyngeal wall was markedly reddened and presented a mass protruding forward and filling most of the oropharynx. On the right side the mass was in contact with the base of the tongue Digital examination revealed the swelling to be smooth soft and nonpulsating The temperature was 102° F The nasal mucosa was reddened but no pus was seen The ears were within normal limits The left neck presented well healed burn scars and the right neck presented small tender nodes in the posterior and anterior chains

The patient was sent for immediate X rays of the neck and chest. Medical consultation revealed the heart and lungs to be within normal limits

Fig 1 Shows neck after injection of iodized oil through the pharyngeal incision The peripharyngeal space is outlined and destruction of the vertical fibrous septum is seen

X-ray Report (see Fig 3) There is no evidence of destruction involving the bodies of the vertebrae and the intervertebral discs are intact. There is pronounced increase in the soft tissue distance between the bodies of the cervical vertebrae and the trachea due to soft tissue swelling Chest X rays were within normal limits

Laboratory Report White blood count, 21,000, with 60 segmented neutrophiles, 12 stab and juvenile cells 22 lymphocytes six monocytes, red blood count, 3,700,000 with 80 per cent hemoglobin, urinalysis revealed 2+ albumin The Kahn test was negative and the nonprotein nitrogen was 61

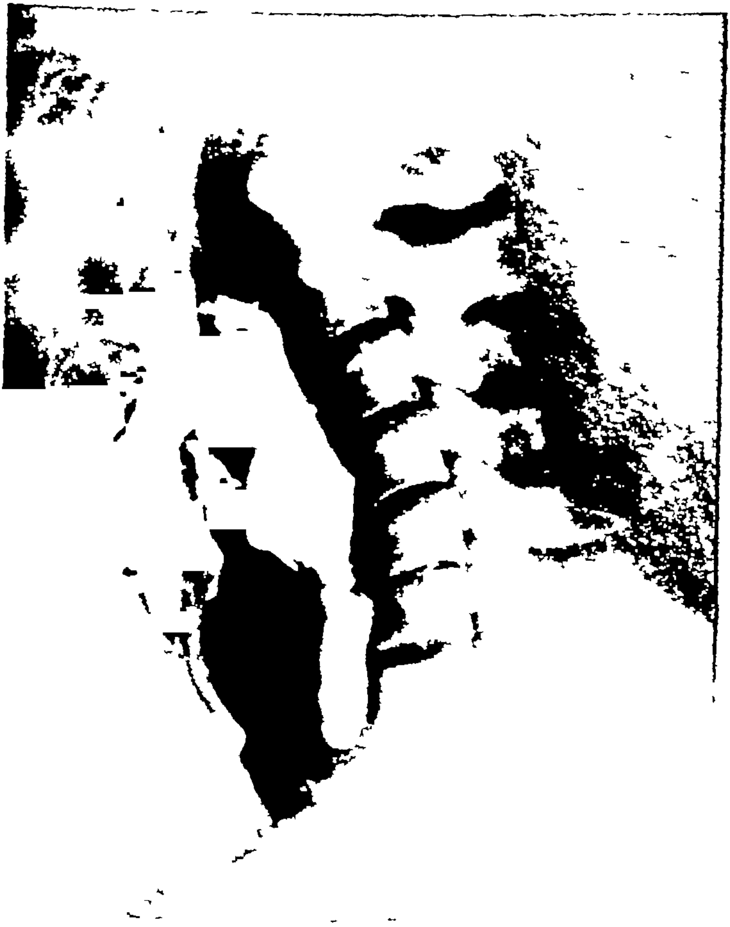


Fig. 5 Lateral view of the neck after injection of iodized oil.

Course in the Hospital Because of marked dehydration the patient was given 1 000 cc. of 5 per cent glucose in normal saline intravenously and 1,000 cc. of Amigen intravenously Penicillin in the dose of 50 000 units was given every three hours A tracheotomy set was placed at the bed side

The morning following admission the patient's respiratory difficulty had increased markedly She was taken to the operating room at once Anesthesia consisted of three or four puffs of a 10 per cent cocaine spray to the pharyngeal wall. With the patient in deep Trendelenburg position an incision was made in the area of swelling slightly to the right of the midline on the posterior pharyngeal wall There was an immediate gush of thick green yellow pus With two suction machines in operation it was possible to keep up with the flow of pus At one point when one suction tip became occluded, the pharynx filled with pus and respirations ceased, it was only when the other suction tip was placed in operation again that the pharynx was opened sufficiently to permit respirations again Approximately 400 cc of pus were recovered

Following surgery, the patient's respiratory difficulty ceased immediaately and she was able to swallow liquids with only little difficulty

Cultures taken at surgery revealed B pyocyaneous The patient was placed on 0 5 gm streptomycin twice daily in addition to the penicillin

Fig 6 Lateral view of the neck showing soft tissue swelling and destruction of the vertebrae

Recovery was uneventful The incision in the pharynx was reopened daily for seven days, at the end of which time there was no further discharge. The patient was discharged on the fourteenth postoperative day

An examination three months postoperatively revealed the patient to have been asymptomatic since discharge from the hospital and examination of the pharynx revealed it to be normal.

Case 2 (see Fig 6) A 54-year-old Negro male entered Homer G Phillips Hospital on Oct. 29 1948 Diagnosis of Pott s disease of the right sacroiliac region was made

X rays at time of admission revealed destructive processes involving the right sacroiliac region and chronic pulmonary inflammatory process

Treatment was instituted at once, but the patient s progress was unsatisfactory and his course was gradually down hill

On Dec. 9 1948 the patient complained of pain in the right side of the neck and an X ray of the cervical spine is reported as revealing a destructive process involving the greater portion of the body of the third vertebra. The anterior portion of the body was quite ragged and irregular on both its inferior and superior surfaces There is no evidence of new bone formation. There is some bony debris in the soft tissues in the region of this body anteriorly There is also some anterior soft tissue swelling'

On Jan. 18 1949 the patient complained of pain in the throat and some difficulty in swallowing Examination at that time revealed a small red slightly tender mass protruding from the posterior pharyngeal wall on the right side.

On Jan. 19 1949 an ear nose and throat consultation was requested Examination revealed a well developed but poorly nourished Negro male in considerable distress and in an extreme state The teeth were poor the tonsils were red and small a large red mass was seen on the right posterior pharyngeal wall almost filling the entire oropharynx on that side

X ray examination of the cervical region of the spine revealed increasing destruction of the body of the third cervical vertebra and there was seen a pronounced swelling of the soft tissues anterior to the cervical vertebrae

The following day the patient s condition was worse he was having marked respiratory difficulty lassitude and weakness had increased The patient was obviously in no condition for extensive surgery for drainage of the abscess in his neck. Simple incision and drainage through the mouth was decided upon. The patient s neck was immobilized in a plaster cast prior to surgery

With the patient in deep Trendelenburg position and using 1 per cent novocaine infiltration anesthesia' the mass in the pharynx was incised Approximately 100 cc of thin yellow pus were recovered Two suction machines were utilized to clean the pharynx and to maintain an airway

Cultures taken from the pus obtained at surgery were reported as revealing no growth

Immediately following surgery, the patient was more comfortable and was able to swallow fluids with less difficulty Postural drainage was instituted and a nurse was in constant attendance with suction to maintain a clean airway

The patient's general condition, however, continued to deteriorate following surgery He became increasingly more lethargic the following day and expired in coma two days postoperatively Permission for autopsy could not be obtained

BIBLIOGRAPHY

1 Vas, J Quoted by Frank[18]

2 Watson, J A Retropharyngeal Abscess in Adults *Northwestern Lancet* 23 192 194, 1903

3 Faier, S Z Retropharyngeal Abscess of Otitic Origin *Ann Otol, Rhinol and Laryngol*, 42 408-437, 1933

4 MacKenzie, Morell Diseases of the Throat and Nose Philadelphia P Blakiston, Son & Co, 1884, p 70

5 Syme, James Case of Recovery After Extensive Exfoliation of the Vertebra Dentata *Edinburgh Med Jour*, 25 311 313, 1826

6 Grodinsky, M Ludwig's Angina, Retropharyngeal Abscess *Jour A M A*, 114 18 22, Jan, 1940

7 Grodinsky, M Retropharyngeal and Lateral Pharyngeal Abscesses An Anatomic and Clinical Study *Ann Surg*, 110 177 199, 1939

8 Grodinsky, M, and Holyoke, E A The Fasciae and Fascial Spaces of the Head, Neck and Adjacent Regions *Amer Jour Anat*, 63 367-407, Nov, 1938

9 Weintraub, J D A New and Functional Systematization of the Neck Connective Tissues *Tran Amer Laryngol Assn.*, pp 81 109, 1939

10 Weintraub, J D A New Anatomic and Functional Systematization of the Connective Tissues of the Neck *Arch Otolaryngol*, 33 1 30, Jan, 1941

11 Iglauer, S Anatomic Pathologic Studies of Retropharyngeal (Peripharyngeal) Abscesses *Tran. Amer Laryngol Assn*, 61 66 80, 1939

12 Iglauer, S Anatomic Pathologic Studies of Retropharyngeal (Peripharyngeal) Abscesses *Arch Otolaryngol*, 33 31-43, Jan, 1941

13 Iglauer, S Autopsy Studies of a Case of Tuberculous Peripharyngeal Abscess *Tran Amer Laryngol, Rhinol and Otol Soc*, 18 204 209, 1942

14 Proetz, A W In discussion of Iglauer's paper[12]

15 Weille, F L, and DeBlois, E Retropharyngeal Abscess, Problems in Treatment *Arch Otolaryngol*, 39 344 347, Apr, 1944

16 Most, A Zur Topographie und Aetiologie des Retropharyngealen Drusenabscessen *Arch f Klin Chir*, 61 615 627, 1900

17 THOMSON, ST CLAIR Diseases of the Nose and Throat. New York D Appleton & Co 1926, pp 464-468

18 FRANK, I Retropharyngeal Abscess *Jour A M A* 77 517 1921

19 GOLDSTEIN M A. Retropharyngeal Abscess THE LARYNGOSCOPE 18 46-56 1908

20 FURSTENBERG, A C Acute Mediastinal Suppuraton *Tran Amer Laryngol, Rhinol and Otol Soc*, pp 210-229 1929

21. MCKENZIE D Otogenic Pharyngeal Abscess *Jour Laryngol Rhinol and Otol* 30 12-29 1915

22 CUNNINGHAM, H M Retropharyngeal Abscess of Otitic Origin *Tran Amer Laryngol Rhinol and Otol Soc*, 33 542 557 1927

23 RIMER, F H The Diagnosis and Treatment of Retropharyngeal Abscess *Pa Med Jour* 42 1197 1198 July 1939

24 SMITH, J E Retropharyngeal Abscess with Reference to Abnormally Large Percentage of Adult Cases *Ann Otol, Rhinol and Laryngol* 49 490-499 1940

25 CHRISTIERSON S V Retropharyngeal Abscess in Adults with Special Emphasis on Its Etiology *Tran Amer Laryngol, Rhinol and Otol Soc.*, pp 133 153, 1933

26 TUCKER, G Retropharyngeal Abscess from Lodgement of Foreign Body in Esophagus. *Jour A M A*, 84 511 512 Feb 1925

27 BARBOUR, P C Retropharyngeal Abscess *Med Times*, New York 67 404-406 Sept., 1939

28 KISTLER, W K. Retropharyngeal Abscess Diagnosis and Treatment THE LARYNGOSCOPE, 41 568-576 1931.

29 LASZLO, A. F Retropharyngeal Abscess Due to External Injury of Neck. *Ann Otol, Rhinol and Laryngol* 44 226-232, 1935

30 SHEEDY, B D Pharyngeal Abscess. *Med Rec.*, 81 1226-1228 1912

31. BARLOW, R. A. Retropharyngeal Abscess. *Tran. Amer Laryngol, Rhinol and Otol Soc*, 35 316-320 1929

32 WOODWARD, F D Retropharyngeal Abscess *Arch Otolaryngol* 14 467-471, 1931

33 SEVER, J W Abscesses in Tuberculosis of the Spine *Jour A M A* 92 1822-1824 June 1929

34 KYLE, D B Diseases of the Nose and Throat. New York W B Saunders & Co 1915 p 603

35 DOWNIE, W *Glasgow Med Jour* 1903

36 ADAMS J Two Cases of Postpharyngeal Abscess from Impaction of Fish Bones. *Lancet* 2 156-157 1847

37 TAYLOR, J Case of Laryngitis Pharyngeal Abscess Extending Throughout the Posterior Mediastinum from Pharynx to Diaphragm *Lancet* 1 462-465 1846

38 Cline, L C Retropharyngeal Abscess The Laryngoscope, 13 668 Sept., 1903

39 Lyman, H W In discussion of Frank's paper[18]

40 Wylie, A, and Wingrave, V H W Lancet, 1 1042, 1906

41 Travers, F T Retropharyngeal Abscess, Secondary Hemorrhage, Ligature of the Internal Jugular Vein and Common Carotid Artery, with Recovery *Brit Med Jour*, 2 703 704, Sept, 1902

42 Chassaignac *Deutsche Ztschr f Chir*, 57 591, 1902 (quoted by Salinger and Pearlman[50])

43 Craigie, D *N Y Med Jour*, 48 233, 1888 (quoted by Salinger and Pearlman[50])

44 Liang, P T, Liang, P K, and Lei, C H *Brit Med Jour*, 1 967, 1925 (quoted by Salinger and Pearlman[50])

45 Tacey *Glasgow Med Jour*, 1 405, 1868 (quoted by Salinger and Pearlman[50])

46 Insley, J L A Case of Hemorrhage from an Acute Retropharyngeal Abscess *Jour Laryngol and Otol*, 59 428-430, Nov, 1944

47 Mosher, H P Thrombosis of Internal Jugular Vein with Pyemia as a Complication of Retropharyngeal Abscess The Laryngoscope, 29 638, 1919

48 Mosher, H P Deep Cervical Abscess and Thrombosis of the Internal Jugular Vein *Tran Amer Laryngol, Rhinol and Otol Soc*, pp 326 340, 1920

49 Mosher, H P Deep Cervical Abscess and Thrombosis of the Internal Jugular Vein The Laryngoscope, 30 365 375, 1920

50 Salinger, S, and Pearlman, S J Hemorrhage from Pharyngeal and Peritonsillar Abscesses *Arch Otolaryngol*, 18 464 509, 1933

51 Kanavel, A B Retropharyngeal and Postmediastinal Abscesses, *Surg Clin N Amer*, 2 603 615, 1922

52 Moore, I Retropharyngeal Abscess *Jour Laryngol, Rhinol and Otol*, 33 283 284, 1918

53 Witchell, I S Abscess of the Brain Following Tonsillitis and Retropharyngeal Abscess *Arch Otolaryngol*, 29 835 841, 1939

54 Dean, L W The Proper Procedure for External Drainage of Retropharyngeal Abscess Secondary to Caries of the Vertebrae *Ann Otol, Rhinol and Laryngol*, 28 566 569, 1919

55 Lillienthal, H Retropharyngeal Abscess The Safest Method of Drainage *Med Times*, 41 355 356 1913

56 Burckhardt, H Uber die Eroffnung der Retropharyngealen Abscesse *Cntrlbl f Chir*, p 57, 1888

57 Blair, V P Jr Personal communication

58 DIXON, O J Retropharyngeal Abscess as a Cause of Respiratory Obstruction. *Jour Kan Med Soc*, 32 232-235, 1931

59 MCCOY, A. W Idiopathic Retropharyngeal Abscess *Med and Surg Rep* 46 313, 1882

60 LIDDELL, J A. Abscess of the Neck. *Amer Jour Med Sci* 85 231 1883;

61. DAVIDSON Postpharyngeal Abscess *Lancet*, 2 881 1892

62. LANDRY M and BILLARD, J Mastoïdite de Bezold Ouverte dans le Pharynx. *Acta Otolaryngol.*, 11 471-474 1927

63 SHURLEY, E L Diseases of the Nose and Throat New York D Appleton & Co, 1900, pp 155-160

64. GOODALE, J L. Retropharyngeal Abscess in the Adult *Boston Med and Surg Jour* 144 108, 1901.

65 HOLMES, E M Middle Ear Suppuration as an Etiologic Factor in Retropharyngeal Abscess *Ann Otol, Rhinol and Laryngol*, 15 848-867 1906

66 DELNEUVILLE E *La Presse Otolaryngol Belgique* May 1912 (quoted by Alexander and Montague *N Y Med Jour*, 98 227 229 1913)

67 FULKERSON, C B Report of a Case of Otogenic Pharyngeal Abscess with Review of Literature. *Jour Mich State Med Soc* 15 301 304 1916

68 FREUDENTHAL, W In discussion of Mosher's paper[48]

69 BABBITT J A. A Study of Retropharyngeal Abscess THE LARYNGOSCOPE, 34 37-43, 1924

70 KELLY I D Cervical Abscesses Complicating Mastoiditis *Ann Otol., Rhinol and Laryngol*, 35 23-41 1926

71 GLOGAU O Abscess Descending from the Upper Air Passages into the Neck and Mediastinum *Tran Amer Acad Ophthal and Otolaryngol* pp 393-412 1922

72 PRATT, J A. In discussion of Frank's paper[18]

73 MYERS E L. In discussion of Frank s paper[18]

74 FRIEDMAN J and GREENFIELD S D Retropharyngeal Abscess An Experience with 60 Cases *N Y Med Jour*, 113 604 616 Apr 1921

75 BROOKS E B Acute Retropharyngeal Abscess *Tran Amer Laryngol Rhinol and Otol Soc*, 37 248 263 1931.

76 BEYER, A. G Retropharyngeal Abscess Complicating a Mastoiditis in an Adult. THE LARYNGOSCOPE, 41 105-107 1931

77 SELTZ, S Retropharyngeal Abscess Complicating Tonsillectomy with External Approach THE LARYNGOSCOPE. 41 341 345 1931

78 HEMPSTEAD B E Lateral Pharyngeal Abscess Following Mastoidectomy *Tran Amer Laryngol Rhinol and Otol Soc* 39 551 555 1933

79 COOPER, A Principles and Practice of Surgery, edited by A. Lee, Vol I, p 79, 1836 (quoted by Mackenzie[4])

80 BLODGETT, J H Quoted by Mosher[40]

81 EVATT, C W Retropharyngeal Abscess *Jour S Car Med Assn*, 34 287 289, Nov, 1938

82 BRYANT, F L Infection of the Mouth and Pharynx *N Orleans Med and Surg Jour*, 99 566-569, May, 1947

83 THOREK, M, and SHAPIRO, M M Retropharyngeal Abscess in Adults. *Jour Internat Coll Surg*, 9 671 678, Nov Dec, 1946

84 SHAMBAUGH, G E, JR Diseases of the Nose and Throat, edited by Jackson and Jackson Philadelphia W B Saunders & Co, 1945, pp 151 152

85 BRIGHTON G R. Surgery of Nose and Throat, edited by J D Kernan New York Thos Nelson & Sons, 1942, pp 287 289

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp, 580 Fifth Ave, New York 19, N Y

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp, 1117 N Franklin St., Chicago, Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac, Beltone Symphonette

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St. Chicago Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co, Inc, 10 East 43rd St New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc., 50 W 29th St New York 1 N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co, Inc, North Third St., Minneapolis, Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp, 1 W 34th St. New York N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co, 727 Atlantic Ave, Boston 11 Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic

Manufacturer Microtone Co, 4602 Nicollet Ave, Minneapolis 9 Minn

National Cub Model, National Standard Model, National Star Model

Manufacturer National Hearing Aid Laboratories, 815 S Hill St. Los Angeles 14, Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4

Manufacturer Otarion Hearing Aids, 159 N Dearborn St, Chicago, Ill.

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)

Manufacturer Paraphone Hearing Aid, Inc 2056 E 4th St., Cleveland, Ohio

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone, Radioear Permo-Magnetic Multipower

Manufacturer E A Myers & Sons 306 Beverly Rd, Mt. Lebanon, Pittsburgh Pa

Ravox (Semi-Portable)

Manufacturer Zenith Radio Corp 6001 W Dickens Ave, Chicago Ill.

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C

Manufacturer Micronic Corp, 101 Tremont St., Boston 8, Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900

Manufacturer Sonotone Corp, Elmsford, N Y

Superfonic Hearing Aid

Manufacturer American Sound Products, Inc, 2454 S Michigan Ave Chicago, Ill.

Televox Model E

Manufacturer Televox Mfg Co 117 S Broad St, Philadelphia 7 Pa

Telex Model 22, Telex Model 97, Telex Model 99, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550, Telex Model 1700

Manufacturer Telex Inc, Minneapolis 1 Minn.

Tonemaster Model Royal

Manufacturer Tonemasters Inc 1627 Pacific Ave, Dallas 1, Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm Inc 400 W Lake St., Libertyville Ill

Unex Model "A", Unex Midget Model 95, Unex Midget Model 110

Manufacturer Nichols & Clark Hathorne Mass

Vacolite Model J

Manufacturer Vacolite Co 3003 N Henderson St., Dallas 6, Tex.

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc. 120 Broadway, New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A-3-A, Zenith Radionic Model B-3-A, Zenith Model 75, Zenith Miniature 75

Manufacturer Zenith Radio Corp 6001 Dickens Ave, Chicago, Ill.

All of the accepted hearing devices employ vacuum tubes

TABLE HEARING AIDS

Precision Table Hearing Aid *Jour A M A*, 139 785-786, March 19, 1949

Manufacturer Precision Electronics Co 850 West Oakdale Ave Chicago 14 Ill.

Sonotone Professional Table Set Model 50 Report not yet published

Manufacturer Sonotone Corp Elmsford N Y

All of the Accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer, 20 Charlesgate, West Boston 15, Mass
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3, N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A Fenton, 906 Medical Arts Bldg, Portland, Ore
Secretary Louis H Clerf, 1530 Locust St, Philadelphia 2, Pa
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin, 384 Post St., San Francisco 8, Calif
Secretary Dr C Stewart Nash, 708 Medical Arts Building, Rochester, N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

Eastern Section, Hotel Statler, New York, N Y, Jan 5, 1950
Council Meeting, Hotel Statler, New York City, Jan 6, 1950
Combined Meeting, Southern and Middle Sections, Peabody Hotel, Memphis, Tenn, Jan 16 17, 1950
Western Section, Medical Society Bulding, Los Angeles, Calif, Jan 21 22, 1950

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St, Charlottesville, Va
Secretary Dr James M Robb, 641 David Whitney Bldg, Detroit, Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr J Mackenzie Brown, 1136 W 6th St, Los Angeles, Calif
President Elect
Executive Secretary Dr William L Benedict, Mayo Clinic, Rochester, Minn
Meeting Palmer House, Chicago, Ill, Oct 9 14, 1949

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E. Ashley, 384 Post St., San Francisco Calif.
Secretary Treasurer Dr Joseph Hampsey, 806 May Bldg Pittsburgh 22 Pa.

PAN AMERICAN ASSOCIATION OF OTO-RHINO-LARYNGOLOGY AND BRONCHO-ESOPHAGOLOGY

President Prof. Justo Alonso
Secretary Dr Chevalier L. Jackson, 255 S 17th St., Philadelphia Pa.
Second Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology Montevideo January, 1950

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President Dr LeRoy A. Schall 243 Charles St. Boston Mass
Secretary Dr Edwin N Broyles, 1100 N Charles St., Baltimore 1 Md
Meeting Mark Hopkins Hotel, San Francisco Calif., May 1950

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Warren A. Wilson.
Secretary Treasurer Dr Victor Goodhill.
Chairman of Section on Ophthalmology Dr George Landegger
Secretary of Section on Ophthalmology Dr Harold B Alexander
Chairman of Section on Otolaryngology Dr Alden H. Miller
Secretary of Section on Otolaryngology Dr Leland R. House
Place Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd., Los Angeles Calif.
Time 6 P.M., fourth Monday of each month from September to May inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner 115 E. 61st Street, New York 21 N Y
Secretary Dr Norman N Smith 291 Whitney Avenue New Haven 11 Conn.

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Garnett P Morison Charles Town W V
First Vice-President Dr Charles T St. Clair Jr Bluefield W Va.
Second Vice-President Dr Arthur C Chandler Charleston, W Va.
Secretary Dr Melvin W McGehee 425 Eleventh St. Huntington 1 W Va.
Treasurer Dr Frederick C Reel, Charleston W Va.
Directors Dr Eugene C Hartman Parkersburg W Va. Dr Ivan Fawcett, Wheeling W Va.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave, North Nashville 3, Tenn

Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg, Atlanta 3, Ga

Vice Chairman Dr V. R. Hurst, 315 N Center St, Longview, Tex.
Secretary Dr Alston Callahan, 908 S Twentieth St., Birmingham 5, Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St., Philadelphia, Pa

Vice President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore Pa

Treasurer Dr Harry P Schenck, 1912 Spruce St., Philadelphia, Pa

Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA.

Presidente Dr Reinaldo de Villiers
Vicepresidente Dr César Cabrera Calderin
Secretario Dr José Xirau
Tesorero Dr Alfredo M Petit.
Vocal Dr José Gross
Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa.
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho, Dr. F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice-Presidente Dr Luis E Olsen
Secretario Dr Eugenio Romero Díaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez, Dr Nondier Asís R Dr Jorge Bergallo Yofre

BUENOS AIRES CLUB OTORINOLARINGOLOGICO

Presidente Dr Juan Manuel Tato
Vice-Presidente Dr Norberto Von Soubiron
Secretario Dr Oreste E Bergaglio
Pro-Secretario Dr Carlos A Gutierrez
Tesorero Dr Vicente R Carri
Pro Tesorero Dr Jorge Couzo

THE
LARYNGOSCOPE.

VOL. LIX NOVEMBER, 1949 NO 11

REVIEW OF THE AVAILABLE LITERATURE ON THE PHARYNX AND PHARYNGEAL SURGERY FOR 1948

FRANCIS E. LEJEUNE, M.D.,*† and R. E. STUART, M.D.,*
New Orleans, La.

PATHOLOGY

In an excellent article on pathologic conditions of the nasopharynx, Harris[1] points out that most of the errors of diagnosis of nasopharyngeal disease lie not in ignorance of the disease in this location, but rather in carelessness of examination. Symptoms are many and varied, and these are thoroughly discussed. Mirror examination of the postnasal space is advocated and a pharyngoscopic examination is used as a check-up. The problem of treating diseases of the nasopharynx is admittedly not always simple. Various lesions are described and their accepted treatments are discussed. Malignancies are usually proved by biopsies and respond fairly well to radiation. Harris continues with the discussion of atresias of the nasopharynx and terminates with the problem of radiation in hypertrophied lymphoid tissue in this area. This arti-

---

From the Department of Otolaryngology, Ochsner Clinic,* and the Department of Otolaryngology, Tulane University School of Medicine,† New Orleans, La.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Sept. 19, 1949.

cle was ably discussed by Wilkerson. We concur that it is one of the most comprehensive articles reviewed this year, well worth reading.

BACTERIOLOGY

Kolmer and associates conducted an investigation 1 to compare the nasopharyngeal bacterial flora of normal adults with that of adults who were suffering from the common cold, particularly in the early and late stages of the disease, 2 to determine the relative incidence and quantitative importance of different micro-organisms in the nasopharyngeal cultures of those who showed secondary bacterial infections, 3 to determine the influence of fever on the bacterial flora of the nasopharynx in normal persons, and 4 to ascertain whether or not particular micro-organisms are responsible for secondary infections. Nasopharyngeal material taken from normal subjects and from those with the common cold between November, 1946, and May, 1947, was cultured and studied. During this time 332 cultures of material taken from 309 normal adults and 800 cultures of material taken from 146 adults who had a total of 209 attacks of the common cold were made and studied. The same micro-organisms were isolated from adults with the common cold as from normal adults, however, in the person with the common cold the incidences of beta hemolytic streptococci of Group A and staphylococci were slightly but definitely higher than in the normal control, and there was also a slightly increased incidence of H influenzae. Although the incidence of pneumococci was essentially the same in the nasopharyngeal cultures of both series of persons, multiple cultures of patients with the common cold showed a definite increase of pneumococci as compared with multiple cultures of normal controls. The beta hemolytic streptococci of Group A, staphylococci, and pneumococci were found more often and in greater numbers in the late than in the early stages of the common cold. Gamma streptococci, staphylococci, pneumococci, H influenzae and diphtheroid bacilli were isolated in cultures of material of normal adults more often during the Autumn and Winter months than during the Spring months. The beta hemolytic streptococci and the Neisseriae occurred oftener during the Spring than during the Winter months There was practically no difference in the incidence of coagulase-positive staphylococci in the cultures taken from the patients with the common cold and in those taken from normal controls Thirteen different types of pneumococci were noted in cultures of material from normal controls as compared with 15 in cultures from patients with the common cold. The most common types of pneumococci in the cultures of the patients with the common cold were III, VI, X, XI and XIX

Kolmer and associates concluded that the results of this investigation indicate that beta hemolytic streptococci of Group A, staphylococci, and pneumococci are important in producing secondary bacterial infections associated with the common cold, the first two types being the most important Since the pneumococci of Types I and II were absent in this investigation, these authors suggest that the common cold may act to reduce the local resistance of the lower respiratory tract and thus favor infection with pneumococci that gain access to the upper respiratory tract through the patient's contact with carriers Without discussing the merits of immunization against the secondary bacterial infection of a common cold, these authors suggest that if vaccines are employed for immunization they probably should be prepared of beta hemolytic and gamma streptococci, staphylococcus aureus, H influenzae with special reference to beta hemolytic streptococcus of Group A. If the pneumococci are included, at least Types III, VI, X, XI and XII should be used

DIAGNOSIS

Because so little is found in textbooks on the description of the mesopharynx, Woodson[3] presents the results of his observations on this area and points out the necessity of differentiating certain signs and symptoms referable to the mesopharynx as definite diagnostic entities The article is divided into the two parts the first part devoted to anatomy, physiology and pathology, is presented in detail with numerous illustrations and represents considerable work on Woodson's part Two important anomalies are considered 1 prominence of one side of the posterior wall of the mesopharynx much more than the other in many individuals, and 2 the presence of two extremely large, curved, bilateral pulsating vessels (internal carotid) apparently just under the mucous membrane located in the midportion of the usual position by the salpingopharyngeus muscle The second part consists in a discussion of several diagnostic entities These include follicular pharyngitis, mesopharyngeal ozena, large lateral pharyngeal pillars and mesopharyngitis proliferans

ANOMALIES

Oldfield and MacNaughton[4] were able to study the action of the posterior pillars of the fauces through a large pharyngeal fistula These pillars play an important rôle in the production of speech sounds, since their contraction assists in occlusion of the nasopharyngeal isthmus Congenital abnormalities of the pillars result in speech resembling that of the patient with cleft palate Syphilis and accidents associated with tonsillectomies are the commonest causes of severe deformity of the pillars of the fauces

Oldfield and MacNaughton report three cases of congenital abnormalities An interesting observation made by them is that the uvula, in their opinion, has no mechanical function and its contribution is in no way vital to nasopharyngeal occlusion They conclude that nasopharyngeal occlusion is effected by a complex sphincter mechanism composed of overlapping muscle slings The posterior wall of the isthmus is drawn forward to form the ridge of Passavant by the horseshoe fibres of the palatopharyngeal sphincter This concise and well written article on a rather unusual subject should be of interest to all laryngologists

Oldfield[5] points out that the main disability of the patient with a cleft palate is the defect in speech, and the operation for repair of the cleft palate represents merely the first stage of treatment of the speech defect He thinks that it is, therefore, incumbent on the surgeon who has undertaken the treatment of such patients to supervise the after-care until normal or nearly normal speech has been attained To accomplish this it is necessary for the surgeon to understand the mechanism of normal speech A description of the mechanism for the production of speech sounds is given in an informative and lucid manner The persons used in the study of this mechanism were given bismuth meal so as to coat the lips, tongue and palate In addition, lipiodol was injected along the floor of the nose and soft palate Radiographs were taken during the articulation of various sounds This represents an excellent article on cleft palate, which should be of much interest to those concerned with the mechanism of speech

DIVERTICULA

MacCharles[6] reports five cases of patients with pharyngeal diverticula operated on at Winnipeg General Hospital Diverticula occur much more rarely in the pharynx than elsewhere in the gastrointestinal tract, except in the upper part of the esophagus It usually occurs after the age of 50 years and is located low down on the midline of the posterior pharyngeal wall in a naturally weak spot between the fibres of the middle and inferior constrictor muscles The etiology is not fully understood but is presumed to be incoordination of the swallowing mechanism These diverticula gradually increase in size by retaining more and more food and press on the upper part of the esophagus Thus, these patients usually have a mass in the neck. Fluids are more easily tolerated than solid food, so the patient either chews solid foods until they are converted to liquids or maintains a liquid diet There is no other disease in which a patient will spend so long masticating his food The diagnosis is easily made by various swallows The mouth of the diverticulum is at the level of the cricoid

Treatment consists in exposing the posterior pharyngeal wall through an incision in the left side of the neck, then determining the mouth of the diverticulum by passing a Levine tube into the stomach with the aid of an esophagoscope The pouch is carefully sutured, or ligated if small, and removed Feeding is accomplished through the tube for 10 days Care is taken to avoid traumatizing the pharyngeal part Two important anomalies are considered *1* prominence of one side of the posterior wall of the mesopharynx much more than the other in many individuals, and *2* the presence of two extremely large, curved, bilateral pulsating vessels (internal carotid) apparently just under the mucous membrane located in the midportion of the usual position by the salpingopharyngeus muscle The second part consists in a discussion of several diagnostic entities These include follicular pharyngitis, mesopharyngeal ozena, large lateral pharyngeal pillars and mesopharyngitis prolifer ans

ANOMALIES

Oldfield and MacNaughton[4] were able to study the action of the posterior pillars of the fauces through a large pharyngeal fistula These pillars play an important rôle in the production of speech sounds, since their contraction assists in occlusion of the nasopharyngeal isthmus Congenital abnormalities of the pillars result in speech resembling that of the patient with cleft palate Syphilis and accidents associated with tonsillectomies are the commonest causes of severe deformity of the pillars of the fauces

Oldfield and MacNaughton report three cases of congenital abnormalities An interesting observation made by them is that the uvula, in their opinion, has no mechanical function and its contribution is in no way vital to nasopharyngeal occlusion They conclude that nasopharyngeal occlusion is effected by a complex sphincter mechanism composed of overlapping muscle slings The posterior wall of the isthmus is drawn forward to form the ridge of Passavant by the horseshoe fibres of the palatopharyngeal sphincter This concise and well written article on a rather unusual subject should be of interest to all laryngologists

Oldfield[5] points out that the main disability of the patient with a cleft palate is the defect in speech, and the operation for repair of the cleft palate represents merely the first stage of treatment of the speech defect He thinks that it is, therefore, incumbent on the surgeon who has undertaken the treatment of such patients to supervise the after-care until normal or nearly normal speech has been attained To accomplish this it is necessary for the surgeon to understand the mechanism of normal speech A description of the mechanism for the production of speech sounds is given in an informative and lucid manner The persons used in the study of this mechanism were given bismuth meal so as to coat the lips tongue and palate In addition, lipiodol was injected along the floor of the nose and soft palate Radiographs were taken during the articulation of various sounds This represents an excellent article on cleft palate, which should be of much interest to those concerned with the mechanism of speech

DIVERTICULA

MacCharles[6] reports five cases of patients with pharyngeal diverticula operated on at Winnipeg General Hospital Diverticula occur much more rarely in the pharynx than elsewhere in the gastrointestinal tract, except in the upper part of the esophagus It usually occurs after the age of 50 years and is located low down on the midline of the posterior pharyngeal wall in a naturally weak spot between the fibres of the middle and inferior constrictor muscles The etiology is not fully understood but is presumed to be incoordination of the swallowing mechanism These diverticula gradually increase in size by retaining more and more food and press on the upper part of the esophagus Thus, these patients usually have a mass in the neck Fluids are more easily tolerated than solid food, so the patient either chews solid foods until they are converted to liquids or maintains a liquid diet There is no other disease in which a patient will spend so long masticating his food The diagnosis is easily made by various swallows The mouth of the diverticulum is at the level of the cricoid

Treatment consists in exposing the posterior pharyngeal wall through an incision in the left side of the neck, then determining the mouth of the diverticulum by passing a Levine tube into the stomach with the aid of an esophagoscope The pouch is carefully sutured, or ligated if small, and removed Feeding is accomplished through the tube for 10 days Care is taken to avoid traumatizing the pharyngeal wound, for if it is opened, severe cervical infection will develop This is a concise, well written article on a condition that is infrequently seen

A dissecting pharyngoesophageal diverticulum, purported to be the first of its kind reported in the literature, is described by Melamed and Walker[7] It was situated posteriorly between the mucosa and muscularis of the esophagus Ordinary pharyngoesophageal diverticula occur usually in middle-aged persons, whereas this dissecting diverticulum occurred in a 15-year-old boy The position and dissecting feature of this diverticulum were not recognized until at the time of surgical intervention The boy complained of symptoms of only one month's duration prior to operation Comparison with the symptoms and position of pulse diverticulum is interesting

Good observation of an unusual type of case makes this article worth reading

Shallow and Clerf[8] present an analysis of 186 cases of patients with pulsion pharyngeal diverticulum treated since 1936 by a one-stage pharyngeal diverticulectomy By this technique, which is described in the paper, the surgeon and esophagoscopist work together during the entire operation in order that the normal contour of the esophagus might be maintained

Shallow and Clerf believe that these diverticula are caused by intrapharyngeal pressure acting during deglutition This results in weakness between the lower most fibres of the inferior constrictor muscles and the upper borders of the cricopharyngeus muscles in most cases, although it occasionally occurs at other sites

The most frequent postoperative complication in the 100 patients operated on was temporary paralysis of the vocal cord due to retraction of the recurrent laryngeal nerve at the time of operation The one death which occurred in the 100 cases was due to coronary occlusion, one recurrence of the condition was noted postoperatively

Mino and Murphy[9] report the case of an unusually large pharyngeal diverticulum, which was successfully treated by mobilization and exteriorization of the diverticulum, followed 10 days later by excision The diverticulum measured 9 cm. in both transverse and anteroposterior diameters and extended from the first thoracic to the lower border of the thoracic vertebrae It compressed the right upper lobe of the lung

Mino and Murphy point out that everyone agrees that the only treatment of pharyngeal diverticula is surgical, except in the early stages before the sac has a definite neck, however, some prefer the one-stage and others the two-stage technique Each has its advantages In the case reported, the two-stage technique was performed because "the defect remaining in the mediastinum, even though temporary, dictated conservatism"

After a brief discussion of the development of pharyngoesophageal diverticula, Terry[10] points out that repair of esophageal diverticula is an exacting procedure, made all the more difficult because of the enormous elasticity of the esophageal wall and its irregularly plicated structure in its relaxed state Some distension of the esophagus and sac is desirable during repair A light is introduced into the diverticula and as dissection is carried out, the sac is clearly outlined Before the sac is separated from its parent, the light is withdrawn and the esophagus intubated with a large Magill tube The virtue of intubation is twofold to maintain normal position of the pharynx and esophagus and to facilitate placement of sutures in their proper location Frequent complications of this procedure are recurrences, fistular formation and obstruction

This article further serves to emphasize that a generally accepted procedure as intubation of the esophagus offers certain valuable advantages to the surgeon Aside from the purposes already mentioned, it helps prevent closing the esophagus too tightly, thereby producing constriction

FOREIGN BODIES

Fickling and Rowe[11] advocate the use of a faucial pack during extraction of teeth under general anesthesia to prevent foreign bodies entering the larynx Several other types of packs are discussed and the position of the patients during extraction is considered important The impression gained from this short report is that packs are no problem during general anesthesia, but the real problem is how to control the possibility of a fragment of tooth or filling lodging in the lower airway under local anesthesia

Merkel[12] describes a case of a rubber suction cup from a dart impacted in the posterior nares of a boy, 12 years old, for 18 months He was able to find only one other similar case in the literature The patient had accidentally fired a dart with its rubber suction cup into his throat 18 months before and was able to retrieve the dart but not the suction cup Roentgenograms of the chest and esophagoscopy done immediately after the accident gave negative results The patient's gastrointestinal complaints dated from the time of the accident Tonsillectomy and adenoidectomy performed three months after the accident did not relieve the symptoms On nasal examination 18 months after the accident, Merkel found a mass at the posterior end of both inferior turbinates, which he removed at operation Recovery was uneventful This case emphasizes the importance of Roentgenographic examination beginning from the vault of the nasopharynx down to the ischial tuberosities in suspected foreign bodies, as advocated by Jackson

PERFORATION

In a discussion of the dangers of esophageal perforation, Franklin[13] briefly reports the case of a patient in whom such a perforation apparently occurred during performance of gastroscopy On the fourth postoperative day the patient complained of discomfort and the temperature had risen to 101° F Fullness of the lower part of the neck and displacement of the trachea as seen in the Roentgenogram confirmed the diagnosis Immediate incision and drainage plus chemotherapy resulted in rapid recovery This short communication emphasizes the urgent necessity for prompt action in such cases, delay results in a high case mortality rate

ABSCESSES

Richardson[24] reports a fatal case of hemorrhage from the internal carotid artery following incision of a retropharyngeal abscess in a girl five years old One month after the abscess was incised the child was readmitted to the hospital because of profuse nasal bleeding but examination failed to disclose the origin of the hemorrhage After the bleeding ceased she was discharged, but came back one month later because of a second attack of sudden profuse hemorrhage This was followed a few days later by the fatal attack.

Richardson believes the lapse of time between the actual diagnosis of an abscess and a fatal hemorrhage in this case is unusual and is the longest of any reported in the literature The symptoms diagnosis and treatment of pharyngeal abscesses are discussed and it is suggested that the infection is probably spread by means of a lymphangitis which causes an adenitis of the glands lying along the carotid sheath

Robelen presents a report of a child six years old with a retropharyngeal and retrolaryngeal abscess treated with large amounts of penicillin, streptomycin, sulfadiazine and sulfathiazole During the course of the disease maculopapular and nodular cutaneous lesions appeared on the extremities These subsided only after all medication had been discontinued The question is brought up whether these lesions were bacterial metastases or represented an allergic response Little can be drawn from this report because the nature of the rash was never determined The blood culture remained sterile throughout the nodules were never studied bacteriologically to determine if they contained the same organism found in the abscess, and the child was not subsequently tested for hypersensitivity to any of the drugs

Korkis divides abscesses of the pharynx and fauces secondary to acute infections of the pharyngeal structures into two main groups retropharyngeal and peritonsillar The location and development of these abscesses are described It is generally agreed that retropharyngeal abscesses occur most frequently in extremely young children, whereas peritonsillar abscesses are commoner in young adults The diagnosis is not difficult if the pharynx can be visualized satisfactorily, however, the presence of trismus *may* add difficulties to the proper diagnosis *Cyanosis and respiratory obstruction* are frequently present, as is also enlargement of the upper deep cervical glands Incision and drainage with the head-low position is advocated, *preferably* under general anesthesia If the patient's condition warrants a general anesthetic, a more thorough evacuation of the abscess is believed to be obtained, and the procedure from personal experience is much less severe on both patient and physician

DISEASES

Dell'Abate[1] reports what is believed to be the first recorded case of a patient who had entirely recovered in the interval between the initial oropharyngeal manifestations and the outbreak of a leucemic condition The patient was a 33-year-old pregnant woman who had had a tooth extracted because of pain and swelling of the gingival tissues and tongue on that side The local symptoms became worse, fever developed and local manifestations progressed to necrosis The patient had an abortion Local applications of salvarsan and rubiazol, antistreptococcic and antigangrenous serums, sulfonamides and vitamin C resulted in a sloughing away of the gangrenous areas, and the patient appeared to be completely well, however, a few days later left-sided pneumonia and cardiac insufficiency resulted, and the patient was transferred to the medical service, where a diagnosis of acute monocytic leucemia was made The patient died a few weeks later

Sharp[13] reports the case of a 65-year-old woman in whom blebs and blisters occurred on the soft palate, pharynx, left side of the tongue and buccal mucous membrane These eventually broke down, forming small, yellowish sloughs which were extremely painful The only relief obtained was from aspirin-phenacetin mixture and applications of pure carbolic acid to the painful area

In an interesting but brief paper, Goldstein and Calcagno[19] call attention to the fact that the incidence of diphtheria in certain sections of the United States increased in 1944 and 1945 They believe that this increase is expected to continue because of the high prevalence of diphtheria among the Germans and the veteran forces of the United Nations Many of the American troops returning from Europe are undoubtedly carriers of virulent diphtheria bacilli, irrespective of whether or not they have had the disease

Aside from the well established facts leading to the clinical diagnosis of diphtheria, Goldstein and Calcagno enumerate several points not heretofore suggested which proved of great help in making a clinical diagnosis This clinical diagnosis of diphtheria is indicated if the exudate or membrane seems to have extended since the last examination, if the exudate extends above the faucial pillars or if the uvula is involved A limited and fairly well demarcated area of hyperemia about the membrane and absence of extensive inflammatory reaction, especially early in the disease, are positive indications of diphtheria

Of the 16 children with tuberculous cervical adenitis treated at the county branch of the Hospital for Sick Children in London, 70 per cent had tuberculous infection of the tonsils and three had tuberculosis of the adenoids[20] Markham briefly records these cases, because tuberculosis of the adenoids is rarely mentioned in the literature In none of the children was there clinical evidence of tuberculosis, and all were in apparent good health Treatment consisted of removal of the tonsils and adenoids, compression of the glands in which abscesses have developed and general care

Siegel[21] made a study of the effect of sulfadiazine on the hemophilus influenzae, H hemolyticus and Neisseria in 60 feeble-minded but physically normal institutionalized children who were nasopharyngeal carriers of these organisms Throat cultures were obtained before and after the administration of sulfadiazine from both treated children and the controls Organisms were cultured in media containing 0 12 units of penicillin per milliliter

H influenzae was recovered from practically all cultures, only 71 per cent of cultures contained Neisseria H hemolyticus was found to be the most senstive to sulfadiazine and was absent when the drug was used H influenzae colonies were reduced in kind and number, but treatment with sulfadiazine did not rid the nasopharynx of the organism Neisseria were totally resistant to the drug, the colonies remaining unchanged Following discontinuance of the drug, colonies again became numerous even in those treated, however, with H influenzae an increase in drug tolerance was noted

An interesting and unusual case is reported by Spar and Williams[22] in which serious complications followed the use of nasopharyngeal packing for control of epistaxis Spontaneous bleeding necessitated a pack in the nasopharynx for practically two weeks Several days after the initial pack was inserted the patient complained of headaches Necrosis and abscess formation developed in the nasopharynx as a result of the packing, together with a chain of symptoms including involvement of some of the cranial nerves In addition, meningitis developed and evidences of osteomyelitis in this area became apparent The infection eventually responded to chemotherapy and radiation

Faber and associates[23] undertook a study to determine the modes of virus excretion in human poliomyelitis They applied 20 per cent virus for 10 minutes to the central end of the divided infraorbital branch of the right trigeminal nerve in the cheek of Rhesus monkeys On the third day heavy lesions were usually present in the homolateral but not the contralateral semilunar ganglion, whereas only occasional minimal lesions were found in the central components of the trigeminal system in the pons and medulla At the same time, virus was detected in the homolateral but not in the contralateral ganglion Pooled nasopharyngeal washings collected from the second to the fifth day, inclusive, also revealed virus

They then treated four Cynomolgus monkeys of Philippine origin similarly and collected material and pooled them serially on the second, third and fourth days after exposure. The animals were killed on the fourth day. An 0.85 per cent solution of sodium chloride was washed through one nostril with a catheter and the returning fluid was collected from the other nostril. Both this material and the fecal and intestinal contents were concentrated by the technique of Silverberg and subinoculated intrathalamically into Rhesus monkeys.

Results of this study support the hypothesis previously suggested on anatomic grounds by these authors that when poliomyelitis virus, which is known to be axonally conducted, has penetrated a bony surface, entered the telodendria of a peripheral afferent neuron and ascended to the corresponding peripheral ganglia, where it can multiply and infect adjoining neurons, it would then be in a position to spread not only centripetally to the central nervous system but also centrifugally back to the surfaces supplied by the same nerve system. When the poliomyelitis virus was applied to the central end of a divided branch of the trigeminal nerve in the cheek, it traveled centripetally to the corresponding semilunar ganglion within three days. Virus was detected in the nasopharyngeal washings on the third and fourth days, which indicates centrifugal spread to the nasopharyngeal surface. Evidence that the virus had been followed was suggested by the fact that the virus was found in the stool on the fourth but not on the third day. These writers suspect that excretion, like invasion, of poliomyelitis virus occurs through axonal channels.

In a good review article, Schenck[24] describes the signs and symptoms, and treatment of acute lunar tonsillitis, chronic tonsillar and adenoid infections, Vincent's angina, retropharyngeal abscess, peritonsillar abscess and diphtheria. Brief case histories are included to illustrate these common infections of the pharynx and fauces.

Beck[25] describes a case of submaxillary, deep cervical infection in an infant two and one-half months old. A retropharyngeal abscess was suspected because of the symptoms, however, a radiograph revealed no widening of the shadows of the sulfadiazine from both treated children and the controls Organisms were cultured in media containing 0 12 units of penicillin per milliliter

H influenzae was recovered from practically all cultures, only 71 per cent of cultures contained Neisseria H hemolyticus was found to be the most senstive to sulfadiazine and was absent when the drug was used H influenzae colonies were reduced in kind and number, but treatment with sulfadiazine did not rid the nasopharynx of the organism Neisseria were totally resistant to the drug, the colonies remaining unchanged Following discontinuance of the drug, colonies again became numerous even in those treated, however, with H influenzae an increase in drug tolerance was noted

An interesting and unusual case is reported by Spar and Williams[22] in which serious complications followed the use of nasopharyngeal packing for control of epistaxis Spontaneous bleeding necessitated a pack in the nasopharynx for practically two weeks Several days after the initial pack was inserted the patient complained of headaches Necrosis and abscess formation developed in the nasopharynx as a result of the packing, together with a chain of symptoms including involvement of some of the cranial nerves In addition, meningitis developed and evidences of osteomyelitis in this area became apparent The infection eventually responded to chemotherapy and radiation

Faber and associates[23] undertook a study to determine the modes of virus excretion in human poliomyelitis They applied 20 per cent virus for 10 minutes to the central end of the divided infraorbital branch of the right trigeminal nerve in the cheek of Rhesus monkeys On the third day heavy lesions were usually present in the homolateral but not the contralateral semilunar ganglion, whereas only occasional minimal lesions were found in the central components of the trigeminal system in the pons and medulla At the same time, virus was detected in the homolateral but not in the contralateral ganglion Pooled nasopharyngeal washings collected from the second to the fifth day, inclusive, also revealed virus

They then treated four Cynomolgus monkeys of Philippine origin similarly and collected material and pooled them serially on the second, third and fourth days after exposure. The animals were killed on the fourth day. An 0.85 per cent solution of sodium chloride was washed through one nostril with a catheter and the returning fluid was collected from the other nostril. Both this material and the fecal and intestinal contents were concentrated by the technique of Silverberg and subinoculated intrathalamically into Rhesus monkeys.

Results of this study support the hypothesis previously suggested on anatomic grounds by these authors that when poliomyelitis virus, which is known to be axonally conducted, has penetrated a bony surface, entered the telodendria of a peripheral afferent neuron and ascended to the corresponding peripheral ganglia, where it can multiply and infect adjoining neurons, it would then be in a position to spread not only centripetally to the central nervous system but also centrifugally back to the surfaces supplied by the same nerve system. When the poliomyelitis virus was applied to the central end of a divided branch of the trigeminal nerve in the cheek, it traveled centripetally to the corresponding semilunar ganglion within three days. Virus was detected in the nasopharyngeal washings on the third and fourth days, which indicates centrifugal spread to the nasopharyngeal surface. Evidence that the virus had been followed was suggested by the fact that the virus was found in the stool on the fourth but not on the third day. These writers suspect that excretion, like invasion, of poliomyelitis virus occurs through axonal channels.

In a good review article, Schenck[24] describes the signs and symptoms, and treatment of acute lunar tonsillitis, chronic tonsillar and adenoid infections, Vincent's angina, retropharyngeal abscess, peritonsillar abscess and diphtheria. Brief case histories are included to illustrate these common infections of the pharynx and fauces.

Beck[25] describes a case of submaxillary, deep cervical infection in an infant two and one-half months old. A retropharyngeal abscess was suspected because of the symptoms, however, a radiograph revealed no widening of the shadows of the retropharyngeal tissues but definite increase in size of the shadows of the base of the tongue with obliteration of the space between the base of the tongue and epiglottis and with backward displacement of these structures A tentative diagnosis of submaxillary abscess was made Following tracheotomy to relieve the dyspnea and evacuation of a large sublingual and submaxillary abscess, the patient completely recovered Beck states that this was the youngest patient he had ever seen with Ludwig's angina type of infection

A most interesting and unusual case of herpes zoster confined to the distribution of the glossopharyngeal nerve is described by Wright[26] When the vagus nerve is involved, persistent nausea and vomiting are conspicuous features In Wright's case there was ipsilateral involvement of the pharynx, tonsillar fossa, faucial pillars and soft palate The lesions were extremely painful and responded poorly to medications but cleared up with the use of nicotinic acid and phenobarbitone Nausea and vomiting persisted for several days

In an effort to determine the frequency of beta hemolytic streptococcus in patients suffering from sore throat and the response of these patients to local sulfathiazole therapy, Fox obtained throat cultures from 400 patients suffering from sore throat Sixty-four of these had tonsillitis and 336 had a diffuse nonexudative inflammation of the pharyngeal lymphoid tissue and mucous membrane An incidence of 75 per cent of beta hemolytic streptococcus was found in patients having exudative tonsillitis These patients were given sulfathiazole gum to chew The results in patients used as controls indicated that local sulfathiazole therapy was more efficacious than other types of treatment tried The chewing of gum containing 0 25 gm of sulfathiazole for one hour results in the deposition, in the crypts of the tonsils, of a discernible amount of sulfonamide compound

Mangabeira-Albernaz[28] has written a lengthy article in which he proposes some changes in the classification and terminology of inflammations of the throat This problem of classification of the different involvements and diseases of the throat has defied the skill and didactic ability of laryngologists The difficulty is due to the fact that the throat does not represent anatomically or physiologically one single organ but a space made up of independent elements in which the upper digestive and respiratory systems are related Acute tonsillitis is divided into several forms and the chronic into three Pharyngeal infections are likewise divided into a number of forms, and anginas are classified into seven divisions with a multitude of subdivisions This paper represents a great deal of work and a noble attempt to classify correctly the many ailments occurring in the throat, but it is thought that additional classifications and numerous subdivisions of known disease will simply add further burdens to an already overworked student

Gustafson[29] made an experimental study in an attempt to isolate the etiologic agent of a disease of the upper respiratory tract in dogs which is frequently complicated by pneumonia and encephalitic symptoms Nasal washings were taken from infected dogs and irrigated through the nasopharynx of normal dogs Bacteriologic studies on throat washings from both infected and uninfected dogs failed to reveal any organisms which could possibly be considered as a causative agent, however, the results in the dogs which received washings containing antibiotics and those which received washings without antibiotics suggest that bacteria may have some counterpart in the syndrome

The fact that the chorioallantoic fluid harvested from eggs which were inoculated with material used by the ninth passage was sterile is evidence in support of a possibility that the causative agent may be a virus Moreover, disease of the upper respiratory tract developed 14 days after intranasal inoculation with this chorioallantoic fluid

An organism isolated from the stools from some of the dogs and tentatively classified as a Shigella was studied to determine whether it had any relation to the diarrhea and the disease of the upper respiratory tract Diarrhea with positive stool cultures developed in one out of four dogs after they were fed the organism Gustafson could not state with certainty from his study that the Shigella organism was the etiologic agent of the diarrhea observed in several of the dogs used for the passages Moreover, the course of the disease of the upper respiratory tract in the animal receiving a suspension of it during the acute phase of this syndrome was not altered by this organism

Arnaud[30] reports the results of treatment with streptomycin in 85 patients with pharyngolaryngeal tuberculosis The intramuscular injection was employed in 67 and the aerosol method in 18 patients Topical application was usually tried first, and if this was unsatisfactory, injections were given Only mediocre results were obtained by aerosols, which were often poorly tolerated The dysphagia was more readily relieved than the dysphonia and ulcerations The results indicate that antibiotics are the best means, thus far offered, of treating tubercular pharyngolaryngitis

Wille[31] reports a case of a 17-year-old boy, with no clinical evidence of tuberculosis except a weak Mantoux reaction, who had intermittent attacks of epistaxis for two years The bleeding came from what appeared to be an ordinary adenoid growth At adenoidectomy under local anesthesia an almost walnut sized tumor was removed Histologic examination revealed some ulceration on the surface of the adenoid mass, some necrotic areas in the deeper portion with numerous epitheloid cells, and some typical Langhans' giant cells The grouping of these cells was typical of tubercular structure One year later there was almost no evidence of further tuberculous changes

Neiman[32] presents the results of an experiment designed to test the efficacy of sulfathiazole in reducing the bacterial flora causing infectious pharyngitis Included in the series were 129 medical students divided into three groups The 79 subjects in Group A chewed gum containing 0 25 gm sulfathiazole for one-half hour three times a day (total, 0 75 gm), the 75 subjects in Group B served as controls and the 45 subjects in Group C chewed gum containing 0 25 gm sulfathiazole once daily This was continued over a period of eight months, including the Winter months, but apparently there were some intermittent periods when gum was not chewed The subjects were questioned at two-week intervals for a history of that period and those with complaints referable to the upper respiratory tract were examined by the student health officer The chief concern of study was the incidence of infectious pharyngitis as determined clinically The incidences of colds and of irritational pharyngitis are also reported

Results of the investigation revealed that infectious pharyngitis occurred twice as often in Group A (0 75 gm per day) as in Group C (0 25 gm per day) Also, Group B (control) had nearly twice the rate of occurrence as Group A and thus four times the rate of Group C There were no cases of sensitization and no reactions of hypersensitivity Neiman considers this difference in rates significant and concludes that there seems to be a diminution in the incidence of primary streptococcic pharyngitis in persons chewing three sulfathiazole gum tablets daily

There are several significant aspects brought out by this study not discussed by Neiman There were seven cases of infectious pharyngitis in subjects taking the medication but occurring during periods when the gum was not being chewed All seven of these belonged to Group A (0 75 gm per day), whereas none occurred in Group C (0 25 gm per day) Also, the rate of infectious pharyngitis of Group A was twice as high as that of Group C Does this indicate a reduction of resistance of the patient, an increase in virulence of the organism or some other factor causing those on the larger dosage to be more susceptible to infection, or does it indicate that the smaller dosage is more efficient? Neiman does not discuss the severity of the infections which did occur in the groups receiving medication as compared with the controls Also, he reports extremely high concentration of the drug locally, but no figures are given to substantiate this Blood samples did not give a positive result for sulfathiazole

A case of tuberculosis with involvement of the nasal passages and the nasopharynx is reported by Rosenthal [1] because of the rarity of this complication It is apparent from the description of this case that the nasopharyngeal complication was secondary to a pulmonary infection Although this article is interesting, it does not add much, since the tuberculous infection was so extensive that the nasopharyngeal involvement could not be considered unusual

The various types of carotid sinus syndrome are discussed, and the nerve supply to the carotid sinus is described by Ray and Stewart[34] Surgical removal of this nerve supply is generally unsatisfactory, as all branches of the nerves are not always severed and too often the original symptoms recur Ray and Stewart think the treatment of choice is intracranial section of the glossopharyngeal nerve, which is thought to be the main afferent nerve of the reflex Good results have been obtained in the few reported cases of intracranial section of the glossopharyngeal nerve for carotid sinus reflex but a larger series of such cases is needed before intracranial section can be universally accepted

Ravenna and Snyder,[35] in an excellent presentation of an interesting subject, call attention to several important points about infectious mononucleosis which are too frequently overlooked in the routine of a busy practice They discuss the occurrence of edema of the pharynx and larynx in this condition and report that in more than one-half of the patients observed, the pharynx, arches, soft palate and uvula were a brilliant red There was slight to severe edema of all the oral mucosa, which was most evident in the soft palate and uvula Little or no exudate was present The bright red color, the edema, the involvement of the soft palate and the uvula, and the paucity of exudate characterized this type of pharyngeal inflammation Many times patients complained of little or no sore throat Frequently, in infectious mononucleosis there is involvement of the cervical lymph nodes, which, as a rule, are painful to touch The lack of response to sulfonamides and penicillin is strongly in favor of the diagnosis of infectious mononucleosis The diagnosis is always confirmed by hematologic or serologic findings

A case is presented of a patient who had considerable exudate on the tonsils, which eventually appeared in small areas on the arytenoid The larynx was extremely edematous in this particular case

There is no doubt that many cases of infectious mononucleosis are erroneously diagnosed as streptococcal pharyngitis, common sore throat, Vincent's infection, grippe or influenza A large number of patients do not recover promptly after such common illnesses, it is possible that many are actually suffering from infectious mononucleosis, a benign disease but of considerably longer duration

Dalton[36] calls attention to the frequent association of thyroid dysfunction and suppurative sinusitis with lymphoid hyperplasia of the epipharynx and the necessity of correcting these pathologic conditions, when present, before removing hyperplastic lymphoid tissue by physical means In a review of his cases he found that 19 2 per cent of patients had thyroid dysfunction Lymphoid hyperplasia was pronounced in 9 67 per cent, moderate in 32 88 per cent and slight or absent in 57 35 per cent There was no sinus infection in 72 2 per cent, moderate infection in 20 per cent and severe infection in 7 8 per cent of cases There were five times as many females as males Hyperactivity of the thyroid gland occurred three times as often as hypoactivity It is important to remember that slight thyroid dysfunction produces a more severe systemic reaction in a child than in an adult, and children respond more quickly and more completely to treatment than do older persons Dalton points out the importance of following a stereotyped routine history and physical examination to avoid a mistaken diagnosis

Bixby[37] reports the results of a study of 139 cases of diphtheria of the nasopharynx proved by positive culture encountered during a period of eight months at the 97th General Hospital in Frankfurt, Germany Two methods of treatment were used The first group of 88 patients received the "routine treatment" consisting of bed rest and the usual supportive treatment plus 100,000 units of diphtheria antitoxin intramuscularly The second group received the same treatment as Group I, but in addition 200 000 units of penicillin were administered every three hours until 1,000,000 units had been given The results of this study proved that the penicillin-treated patients recovered more promptly, required shorter hospitalization, had fewer complications and showed a decrease in the incidence of carriers. This study proves the well known contention that penicillin is effective against corynebacterium diphtheriae. It is rather astounding that 139 patients with diphtheria of the nasopharynx should be seen in so short a time. Obtaining cultures from all patients with acute nasopharyngeal conditions would likely make us more conversant with this type of disease.

Rovenstine and Papper[38] describe a new technique for blocking the glossopharyngeal nerve, which they consider simpler and more effective than methods ordinarily used. It consists in drawing a line connecting points at the tip of the mastoid bone and the angle of the mandible and bisecting these, then raising a skin wheal at the midpoint of this line. A 5 cm. fine calibre needle is then inserted in a direction vertical to the skin for a depth of from 2 to 4 cm. medial to the surface of the skin until the styloid bone is encountered. The needle is then reinserted in such a way that the point passes 0.5 cm. deeper and posterior to the bony styloid. At this point the procaine hydrochloride is injected slowly after careful aspiration. From 4 to 8 cc. of 1.5 per cent solution of procaine injected on each side will produce adequate anesthesia of the tongue for about 75 minutes. Two illustrative cases are described. Block was performed in one for insertion of radium into the base of the tongue and in the other, a case of leucoplakia of the tongue, as a diagnostic measure before surgical interruption of the glossopharyngeal nerves was recommended.

In an excellent article, McLorman[39] emphasizes the importance of performing tracheotomy in cases of paralysis of the pharyngeal muscles resulting from diphtheria or bulbar poliomyelitis. As stated by McLorman, these patients have weakened respiratory muscles (intercostals and/or diaphragm) as well as excessive secretions within the trachea. These secretions are frequently aspirated, and this inhibits proper use of an artificial respirator by a nonpatent airway. Removal of secretions from the pharynx by suction is undesirable because it is traumatic and must be performed frequently. Trache otomy offers an easier and more thorough means of removing the secretions and lessens the burden on the weakened respiratory muscles

Rethi[40] discusses the two known technical varieties of transverse pharyngotomy in which incisions are made above or below the hyoid bone, which have been designated as suprahyoid and subhyoid pharyngotomies Since both of these approaches have certain disadvantages, Réthi made an attempt to devise a technique which would unite the advantages of both approaches, that is, the free insight upward and downward, excluding aspiration even in the cases of abundant bleeding and securing uneventful healing of the wound This technique is always preceded by a tracheotomy and the pharyngotomy incision is at the level of and extends from one end of the hyoid bone to the other A detailed description of the technique, which appears a bit complicated, is presented The hyoid bone is severed in its middle portion and the mucosa of the pharynx is severed in a vertical line The exposure obtained appears excellent for lesions or tumors on the base of the tongue, lateral pharyngeal walls, epiglottis and upper portion of the larynx Two cases of goiter of the base of the tongue are appended The one treated by suprahyoid pharyngotomy was followed by suppuration of seven weeks' duration and descensus laryngis In contrast, uneventful healing followed transverse pharyngotomy in the other case

Kilbourne and Loge[41] present the results of one phase of an investigation of 127 men in an army camp who contracted hemolytic streptococcal pharyngitis The criteria for diagnosis were strict and apparently well observed These men were divided by rotation into three groups without regard for the severity of their illness when admitted A group of controls received no therapy specific for the disease, another group received intermittent therapy (300,000 units crystalline penicillin in aqueous solution once daily for six to seven days), the third group received continuous therapy (20,000 to 50 000 units crystalline penicillin in aqueous solution every three hours for four to seven days)

The antistreptolysin titre was followed on the various patients with the following results the untreated group showed a relatively high rise in titre in a large percentage of cases, the group receiving continuous therapy showed a rise in titre less frequently and in smaller magnitude, whereas the group receiving intermittent therapy showed an intermediate response in incidence and in degree

The comparable efficacy of these three treatments is not reported in this paper, but the occurrence of late relapses is brought out There were no relapses in patients who received continuous therapy or who had a rise in antistreptolysin titre All patients who did have relapses manifested rises in the titre prior to or coincident with the appearance of the late sequelae

From this study the conclusion was drawn that penicillin therapy suppressed the formation of the antistreptolysin titre in these cases of hemolytic streptococcal pharyngitis to a degree proportional to the duration of the antibacterial action of penicillin maintained during the 24-hour period, the response being suppressed more by continuous than by intermittent therapy This may be significant in view of Kilbourne and Loge's observations and their report of other writers that later sequelae, such as rheumatic fever and glomerulonephritis, develop in those cases in which a rise in antistreptolysin titre occurs

This investigation appears to have been well planned and executed, the conclusions are conservative and consistent with the findings, and the report is clear and concise

Kyper and Cross[42] report a case of Thornwald's bursitis which was resistant to Roentgen therapy and surgical intervention They believe the patient failed to improve probably because the cavity of the bursa, extending as it does back near the occipital bone, is inaccessible to the surgeon They point out that if this nasopharyngeal cavity is chronically infected, it may act as a focus of both local and systemic complications The chief symptoms are headache, chronic pharyngitis, postnasal discharge, sinusitis, frequent colds and hoarseness These bursae should be excised or the abscess should be opened if the median recess of the adenoid is closed because of inflammation

Wenner and Tanner[43] conducted interesting experiments in an effort to determine risk of attack among persons living in households in which poliomyelitis existed They showed that frequently in several members of a family, clinical or subclinical attacks of the disease develop and it was found that carriers of virus were concentrated about households in which there was a paralyzed patient It is thought, therefore, that in these *loci*, apparently, there is wide distribution of virus in humans

A widespread outbreak of poliomyelitis in Kansas served to carry out studies on cultures from the oropharynx, blood and stools Throat cultures were made on admission to the hospital and during the ensuing days cultures were obtained from the throat of each member of the household An interesting description of the work performed and an analysis of each family seen is tabulated The results of the study showed that the virus of poliomyelitis has a wide distribution in members of these households Wenner and Tanner were able to show that out of 24 members examined, 17 had poliomyelitis virus in their intestinal discharges and in seven virus was detected in the throat

Theobald[44] presents a report of the study of the wide variety of symptoms and complaints referable solely to the epipharynx in 150 patients All other factors which might produce the symptoms were carefully eliminated Thus, a sinus condition producing postnasal discharge, epipharyngeal conditions, secondary to diseases of the nose, and allergic disturbances were not included The ages of the patients ranged from five to 75 years, with the majority (16 6 per cent) in the 40 to 45-year range There were 58 males and 92 females.

The most frequent complaint was postnasal discharge and the next was recurrent sore throat The other complaints in order of frequency were cough, earache, recurrent colds, hoarseness, bronchitis epipharyngitis, fever, bleeding, crusting, occipital headache, asthma and tuberculosis Each symptom is briefly discussed In regard to epipharyngeal examination, Theobald prefers direct nasopharyngoscopy with the Yankauer speculum

Treatment in these cases consisted of operation, irradiation and local therapy Hypertrophied lymphoid tissue was treated by surgical removal, followed by radium, according to the Crowe technique Local treatment usually consisted in cauterization with 5 per cent solution of silver nitrate, those who did not respond to this were treated with radium A note of warning is included concerning the question of previous radium therapy and what the effects of irradiation therapy might be

Morrison[45] reports the case of a 66-year-old woman in whom the IXth cranial nerve was avulsed by the extracranial approach for glossopharyngeal neuralgia On the first postoperative day she had a severe attack of pain about the ear, which Morrison believed was due to central stimulation of the area from which the nerve was torn Three years postoperatively the patient still has slight pain around the ear, which is relieved by aspirin, and some difficulty in swallowing dry food, which is overcome by drinking water Slight facial paresis, evident in the early postoperative period, has disappeared Of course, the right side of the back of the tongue, the right tonsil, the fauces and the right side of the soft palate are insensitive

Morrison believes that the extracranial approach may be preferable to the intracranial route in elderly patients who are worn out from the pain He cites the cases of two patients operated on by Williams in whom relief of pain has been obtained up to eight and 10 years, respectively, following operation The technique of the extracranial route is described in detail because Morrison considers as unnecessarily severe some of the techniques referred to in the literature in which the posterior belly of the digastric and stylohyoid muscles and even the external carotid are divided

Loge and Kilbourne[46] made a study of 184 patients with a preliminary clinical diagnosis of streptococcal pharyngitis during a two months' period in the Spring of 1947 "*1* to delineate the natural history of this epidemic of streptococcal pharyngitis in a young adult male population, *2* to assess the value of two methods of penicillin treatment as compared with purely symptomatic therapy, *3* to determine and evaluate the antistreptolysin response of patients in each of the three treatment groups" This paper is concerned with the natural history and results of treatment in 127 patients with streptococcal pharyngitis The "untreated" group received hot saline gargles or irrigations, obligatory bed rest for three days and codeine when necessary The "treated" group received, in addition to these measures, penicillin either in a single daily injection of 300,000 units for about a week or in dosage comparable to the usual experience

The results indicate that penicillin, regardless of the method of administration, did not significantly alter the symptomatology of the disease but did reduce the period of pyrexia and leucocytic reaction Pyogenic complications occurred in four untreated patients, in none of the patients who received penicillin in conventional dosage, and in two of those receiving the single daily dosage Late complications of the infection occurred in none of the patients who received penicillin in the conventional manner, but rheumatic fever developed in three patients receiving intermittent penicillin therapy, and late complications occurred in two patients receiving symptomatic therapy The five relapses occurred in penicillin-treated patients The incidence of positive cultures observed at the end of three weeks was greatly reduced in the penicillin-treated patients It was also noted that penicillin therapy reduced the incidence and degree of antibody response as measured by the antistreptolysin There was less interference with the antibody mechanism in the patients treated with the large single daily injection of penicillin

IRRADIATION

In an article devoted primarily to a discussion of the American literature on the treatment and prevention of deafness of tubal origin by radium therapy, Reynaud[4] draws the following conclusions

1 Radium therapy of the rhinopharynx can and must be employed with great possibility of success in children with deafness of tubal origin In the adult the chances for success are fewer, but exaggeration of the secondary lesions of the middle ear can be prevented and the results are fairly good It is important to treat young patients as long as there is lymphoid hyperactivity and instability of auditory function

2 The salpingoscope and the nasopharyngoscope are the best means of making satisfactory and repeated examinations of the cavum in the child

3 Radium therapy is not entirely without danger of intercurrent otitic complications These complications have been rare in the hands of American physicians because of careful selection of patients and extreme care in the dosage and duration of irradiation

Fox[18] discusses the need for treating children who have infected adenoids or sinus suppuration secondary to an obstructive adenoid mass This article is concerned chiefly with the relative value of adenoidectomy and nasopharyngeal radiation The latter is not a substitute for the former, for each has its definite indications and limitations, and not infrequently they are best used together

Radiation therapy may be defined as the therapeutic use of the rays which emanate from radium The mixture of the three rays is known as radon and may be captured in a capsule and used as such but is exhausted in a matter of hours Also, the radium itself may be placed in a capsule and used The alpha rays are of little value because they have no penetrating ability, being absorbed by the thinnest screen The beta rays can penetrate up to 3 mm of soft tissue and are completely absorbed by 1 mm of lead The gamma rays can penetrate up to 6 to 8 inches of soft tissues or 5 5 inches of lead They are considered best for therapy, a suitable capsule being chosen to filter out the more numerous or more irritating beta rays Deep Roentgen therapy is similar to gamma radiation except for the secondary effect on the tissues and organs penetrated to reach the selected part In the usual therapeutic dosage radiation does not destroy or remove lymphoid tissue It inhibits mitosis and cellular multiplication and thus secondarily reduces the size of the mass

In comparing surgical treatment and radiation, Fox points out three instances in which the former is better used cases in which the mass in the nasopharynx is large, has never been removed, or in which immediate results are needed Radiation is used if the amount of tissue is small or inaccessibly located Both are advocated in children under two years of age because there is recurrence of some tissue in almost 100 per cent of these cases

Fox uses combined deep Roentgen ray therapy and gamma radium radiation The average patient receives 1,000 tissue Roentgens to the nasopharynx within 30 days, given in five to six divided doses At the time of the second and fifth treatments 50 mg hours of gamma radium radiation are given to each side of the nasopharynx

The use of beta radium rays is found to be not quite so good as the combination of Roentgen ray and gamma radium but is the most suitable method for dealing with large numbers of cases, at the operating table and in young infants The method is employed by way of a monel metal capsule with an outside diameter of 2 3 mm and containing 50 mg of radium One to four treatments are required (usually three) at two to three-week intervals The treatment consists of leaving the applicator in each side of the nasopharynx for 6 5 to 8 5 minutes No visible results are manifested before four to six weeks, and usually longer is required Fox cautions against indiscriminate use

This is a good summary of the use of irradiation up to the time of its publication, but further changes have been advocated and at the present time a 50 mg radium applicator is inserted to each side of the nasopharynx for 12 minutes

Bernstein[49] states that irradiation of the nasopharynx is of great benefit in cases of deafness in children, due to partial occlusion of the Eustachian tubes by hyperplastic and chronically infected lymphoid tissue in and around the tubes, recur-

Scal[54] outlines the indications for irradiation of the lymphoid tissue in the nasopharynx for the prevention of deafness and treatment of infections of the upper respiratory tract Lymphoid tissue is known to be sensitive to radiation, the rays act on the germinal center of the cells, inhibit mitosis and prevent further function and growth of new lymphocytes to replace those destroyed In a series of 38 cases treated by this method for impaired hearing, pronounced improvement in hearing acuity was obtained in the majority of cases It appears that the present enthusiasm for radiation therapy is definitely warranted because of the excellent results obtained, up to the present time I know of no bad results developing in any patient who has received radiation therapy

Fox and West[55] have devised a cylinder receptacle of chrome-plated brass, 17 cm high, with an outside diameter of 4 cm, and walls 3 5 cm thick, for cleansing the nasopharyngeal radium applicator supplied by the Radium Chemical Co A cap of similar material fits over the cylinder This cap contains an opening 13 mm in diameter, through which the applicator may be inserted It is almost impossible to overturn the cylinder since it has a wide, heavy base Within the cylinder are numerous radially arranged bristles which run the entire height of the cylinder A layer of absorbent cotton in the base of the container prevents damage to the radium capsule if it should strike the bottom of the container The container is filled with a fresh solution of 10 per cent "caroid" powder in 1 1,000 aqueous solution of zephiran

To cleanse the applicator it is held by its handle and inserted through the opening in the top of the receptacle and pushed down through the bristles and solution It is moved up and down in order to loosen any adherent material and is left in the solution for about a minute It is then replaced in a two-inch lead block for storage

Adequate protection against the beta rays of the applicator during cleansing is afforded by the thickness of the brass walls The "caroid" acts as a protein digestant and the aqueous zephiran solution as an antiseptic

Jones[56] reviews the results obtained in the treatment of 136 adults who were given 331 irradiation treatments of the nasopharynx The method of application followed the usual routine technique Results were determined by answers to a questionnaire Improvement in hearing was reported by a goodly number and surprisingly enough a number of patients reported improvement from the annoyance of tinnitus The sensation of pressure, noted by some of the patients, was relieved and the incidence of colds was reduced

Jones stresses the importance of accuracy in placing the applicator in the nasopharynx and justly believes that the position of the radium may be the determining factor in obtaining good or indifferent results He further emphasizes the importance of applying irradiation before irreversible changes occur and considers the duration of the symptoms to be more important than the age of the patient He concludes that irradiation therapy in selected cases offers better results in conservation of hearing and relief from tinnitus and pressure than any other current method of treatment

The need for treatment of hypertrophied adenoid tissue is explained by Woodbridge[57] under two broad headings *1* children with repeated attacks of deafness and/or aural infection, and *2* flyers with aerotitis With reference to the former, Woodbridge points out that Crowe observed that more than 75 per cent of adenoidectomies, many in good hands, resulted in pronounced recurrence of lymphoid tissue After discussing the various difficulties and disadvantages of using Roentgen rays on these children, Woodbridge concludes that the radium applicator is the most practical method of treatment With reference to the problems of the aviators, the advantageous use of the radium applicator on those men making high altitude flights is pointed out

This article brings out nothing new, Woodbridge having only recently started using the applicator himself Instead, he quotes freely from two articles which previously appeared in national journals He brings out two points which the abstractors question *1* that there is "a layer of diffuse lymphoid tissue beneath the epithelium throughout the length of tube," and 2 the implication that nasopharyngoscopic examination of the tubal orifices gives a correct indication of the function of the tube

According to Nervert and Kallen,[58] the Radium Chemical Co revealed that the container in common use for the nasopharyngeal radium applicator was designed for transportation only It provides one-inch radial protection, which is inadequate against harmful rays These authors report a unit which contains the necessities for treatment with, and cleansing and housing of the applicator It also provides adequate protection in storage The apparatus consists in general of a lead decanter of three-inch radius at the base and a cap for protection around the handle of the applicator The whole is enclosed in a wooden case which contains the cleansing essentials and the time clock

Minchew and Collins[59] present an excellent general review of radiation therapy of the nasopharynx for impaired hearing due to hypertrophied lymphoid tissue They discuss the incidence, diagnosis and pathology of the condition They recommend four treatments of radium, 12 minutes to each side, two weeks apart Improvement of more than 15 db was obtained in 66 per cent of 18 of their patients with impaired hearing caused by lymphoid hypertrophy obstructing the Eustachian tube treated in this way during one year

BENIGN TUMORS

Waltner[60] reports two cases of extramedullary plasma cell tumors, which, he concludes, occur rarely in the nasopharynx compared to those arising in the bone marrow These plasmocytomas are described as polypoid or sessile growths, or as a more or less circumscribed swelling of the mucous membrane Some are large and others are no larger than a bean Waltner points out that benign plasmocytomas may show malignant behavior many years after their discovery As long as neither the clinical nor histologic appearance can give a reliable indication of the future course of these tumors, early radical removal of the extramedullary tumor associated with deep Roentgen therapy seems to be indicated in every instance

Koop and associates[61] remind us that neurilemmonas may arise in any portion of the body where nerve sheaths exist That the pharynx is an uncommon site for such a tumor is evidenced by the fact that only six such cases have been reported in this locality Although these tumors are benign, they occasionally become quite large and because of their location are extremely difficult to remove endorally, so that in most instances they must be removed through a cervical incision A case is described in which five neurilemmonas were removed, this brings the number of reported cases in the literature to 11 Good results were obtained in all reported cases

According to Knight and Bunting,[62] only 37 cases of tracheal fibroma have been reported in the literature They describe a case in a boy 20 years old A lateral Roentgenogram revealed a large mass protruding from the posterior wall of the trachea, 5 cm below the larynx It was thought to be an adenoma The tumor, which was occluding four-fifths of the airways, was completely removed and the patient had an uneventful convalescence

Diamond and Perkins[63] report a case of calcified hematoma of the oropharynx secondary to a gunshot wound It is reported because of lack of similar cases in the literature and as a contribution to the differential diagnosis of pharyngeal tumors The patient was a 70-year-old man who complained of progressive hearing impairment of the left ear Twenty-nine years previously he had been shot in the face, the bullet passed from the left side of the nose and through the roof of the mouth to the atlantoaxial region and had been left *in situ*. Examination revealed a 4 cm smooth, bony hard, hemispheric swelling in the left lateral, posterior pharyngeal wall which showed as a calcareous deposit in the Roentgenogram As there was some question of neoplasm, the mass was aspirated and 5 cc. of jelly-like material was obtained This was reported by the pathologist as "calcific material" Diamond and Perkins felt that this represented a calcified hematoma and that no further treatment was indicated

McFarland[95] reports a comparatively rare case of a lipoma occurring on the left side of the pharynx in an infant three months old A diagnosis of retropharyngeal abscess was made, however, incision proved the mass to be an encapsulated tumor of yellowish white tissue and the histologic report revealed it to be a lipoma

In a classic article, Martin, Ehrlich and Abels[96] discuss all phases of juvenile nasopharyngeal angiofibromas, which are neither common nor malignant neoplasms, nevertheless, these tumors present serious problems because of the complications invariably associated with their growth and treatment Twenty-nine cases of juvenile nasopharyngeal angiofibroma are analyzed It is generally agreed that all these tumors are highly vascular and noninfiltrating The angiofibroma is one of the few types of tumors which exhibit a pronounced sex predilection, it occurs in the nasopharynx or posterior nasal cavity of pubescent males The outstanding symptom is nasal obstruction, and later recurrent epistaxis develops The etiology, histology and pathology of these tumors are discussed and the opinion is expressed that the clinical diagnosis should always be confirmed by biopsy Martin and co-workers emphasize the fact that nasopharyngeal fibromas show some degree of spontaneous regression at the time of sexual maturity It is interesting to note that complete regression of the tumor occurred in one patient who received sex hormone therapy This therapy is advocated routinely by Martin and associates Roentgen therapy is of much value as all hemangiomatous lesions are moderately radiosensitive Implantation of radium needles or radon definitely helps to reduce the size of the neoplasm and constrict blood vessels Surgical excision is hazardous and it is thought wise to ligate both external carotids when serious hemorrhage is a complication If the size of the tumor has been reduced by radiation, surgical excision may be considered Martin and co-workers are of the opinion that the prognosis as to life is excellent and it is thought that practically all patients with this type of neoplasm should recover and become free of symptoms when sexual maturity is reached

This article represents one of the best attempts to discuss all phases of nasopharyngeal fibromas. It is highly probable, as suggested by Martin and associates, that a sex-endocrine relationship exists in these cases.

Lillie and Heck[66] report the case of a Filipino, 45 years old, with a chief complaint of recurrent cough of one year's duration and mild pharyngitis. On examination the left lateral pharyngeal band was found to be thickened, edematous and red, extending from the posterior tonsillar pillar inferiorly to the salpingopharyngeal fold superiorly. A preoperative diagnosis of hypertrophy of the left lateral pharyngeal band was made. The lateral pharyngeal pillar was removed. The pathologist reported the lesion to be a hemangioma. Neither Horner's syndrome nor paralysis of the vocal cord occurred postoperatively. This case is of interest because of the unusual location of the tumor on the lateral pharyngeal band, the unusual clinical symptoms, the rarity of occurrence of hemangioma in the pharynx and the fact that the tumor was not identified until it had been removed. Lillie and Heck postulate that the cough in this case may have been caused by vagal irritation transmitted by way of the visceral sensory fibres to the pharynx.

Harkonen and Malmio[67] present the results of treatment of 31 patients with broad fibroma treated by Roentgen therapy alone, by operative and radium therapy, or by radium alone, between 1929 and 1945. Follow-up examinations were done on 21 patients and 10 answered questionnaires. The average age was 16.5 years. Of the 20 patients who recovered, three improved and in eight treatment has not been completed but the patients are improved. There have been no deaths. Of the patients treated either by operation alone or with radiation 67 per cent recovered and 63 per cent of those treated by radiotherapy alone recovered. Of course, less time was required for treatment of patients by operation than by radiotherapy. Immediate recovery occurred in 50 per cent of patients with pedunculated neoplasms treated by Hopmann's operation. Radiotherapy either made the tumors disappear or limited their growth.

MALIGNANT TUMORS

Wang[98] summarizes the results of his study of 36 cases of malignant tumors of the nasopharynx seen between 1937 and 1943 at the Chengtu Eye, Ear, Nose and Throat Hospital The ages of the patients ranged from less than 20 years to over 70 years, nearly one-third occurred between 25 and 35 years There were only three females in the 36 cases Ninety two per cent were carcinomas of some type — 19 instances of transitional cell carcinoma or lymphoepithelioma, 10 of unclassified carcinoma, four of squamous cell epithelioma, and one case each of lymphosarcoma, malignant melanoblastoma and reticuloendothelioma

The tumor occurred most frequently in the lateral wall of the nasopharynx about the Eustachian tube, especially in the fossa of Rosenmuller The appearance was usually a small, irregular, nonpedunculated mass which could be seen with the mirror It was usually ulcerated, had a dirty gray exudate and bled on contact It was generally not painful The upper deep cervical nodes were usually involved, and this occurred early in the disease (50 per cent) The nodes were rubbery hard or cork-like The overlying skin was not ulcerated or otherwise involved The primary tumors in this series spread in various directions, including extension into the paranasal sinuses especially the sphenoids and ethmoids Extension upward involved the IInd cranial nerve in two cases, the IIId in five cases, the Vth in 17 cases, the VIth in 13 cases, the VIIth in six cases, the IXth in three cases, the Xth in 11 cases, the XIth in three cases and the XIIth in 12 cases

Involvement of the structures of the head is divided into four groups aural, nasal, ocular and others Aural involvement produced tinnitus, altered sensation in the ear, impairment of hearing and aural discharge The nasal symptoms consisted of partial or complete obstruction, attacks of hemorrhage, or blood-tinged mucoid discharge The ocular manifestations were pain in the ocular region, ptosis, diplopia, exophthalmos and impairment of vision in advanced cases The fourth group included bulging of the soft palate, pain in the forehead, side of face or temporal regions, numbness of certain areas of the face or lips, dysphagia, hoarseness, enlargement of the cervical lymph nodes and metastasis to distant parts of the body

The duration of early symptoms from onset to first examination was two to three months in four cases, four to six months in 11 cases, seven to 11 months in seven cases, one to one and one-half years in six cases, two years in six cases, and three years in two cases

Wang stresses the importance of a nasopharyngeal examination in any patient with the symptoms already mentioned, especially those of the nasal group, in addition to headache and cervical adenopathy Headache was a prominent early symptom in 12 patients, nasal obstruction in 20, attacks of nasal bleeding and bloody discharge in 17, and cervical adenopathy in 18 cases Nasal symptoms, in addition to tinnitus and impairment of hearing, occurred in 64 per cent of the cases and as a rule were among the earliest subjective complaints Wang further stresses that biopsy should be done in the presence of any bulging, especially in the lateral nasopharyngeal wall, though it be smooth and regular He points out that a positive result of biopsy is rarer after radiotherapy has been instituted and that a negative result does not exclude malignancy

The prognosis in Wang's series was found to be bad, the disease usually running a fatal course in less than 3 5 years The tumors were found to be inaccessible to surgery, but usually rather radiosensitive The method used at the Chengtu Hospital was packing radium needles into the nasopharynx and inserting the needles into the regional lymph nodes when involved

This report indicates a learned investigation of 36 cases It confirms the work of others and emphasizes many significant phases of this important subject

A study of 34 cases of tumors of the nasopharynx seen during the past 25 years is presented by Davis[69] These included 19 cases of carcinoma, four of lymphosarcoma, 10 of angiofibroma and one of myxosarcoma These types are comparatively rare and in many cases unsatisfactory to treat The early diagnosis of these tumors is frequently delayed because they are hidden in a cavity which is difficult to inspect Delay in consulting a physician early seems to complicate further an already difficult problem, however, this is probably due to the fact that there are no definite and reliable early symptoms which would seem to warn the patient of the existing lesion Davis discusses the various symptoms and concludes that deep Roentgen ray therapy is the best treatment for nasopharyngeal malignancies These cases are inoperable when first seen Radium has not given as good results as Roentgen ray therapy The problem of the nasopharyngeal fibroma, which occurs in males between the ages of 10 and 20, is also discussed These are benign tumors which are extremely vascular and, therefore, present real surgical problems

An interesting discussion of this article was given by Gardham, in which he marvels at the remarkable geographic distribution of these types of tumors In Hong Kong, 25 per cent of all surgical malignant lesions were in the nasopharynx

The variety of symptoms contributes to the difficulty of early diagnosis in these cases Nasopharyngeal examination in those sensitive patients who gag easily can best be carried out by pharyngoscopic examination which will establish the diagnosis readily Every patient with bizarre symptoms should be given the benefit of a pharyngoscopic examination and only in this manner may we hope to obtain earlier diagnosis

The clinical characteristics of 46 cases of malignant tumors of the nasopharynx studied at Johns Hopkins between 1925 and 1946 are reviewed by Van Metre[70] Sixty-three per cent of these tumors occurred in males and all presented symptoms primarily involving the nasopharynx, ears, cervical glands or cranial nerves These symptoms, together with all other data, are elaborately tabulated for brevity Van Metre states that in his cases if the first symptom was neurologic, in 85 per cent of the cases the Vth nerve caused the pain The lymphatic drainage of the nasopharynx is rich and these tumors are highly malignant Early extension via the lymphatics would be expected Because of the location of the tumor, involvement of the cranial nerves is expected

Graham and Meyer,[71] who point out that fortunately nasopharyngeal malignancies are of rare occurrence, report 29 such cases encountered in a 10-year period Because the lesion is not easily accessible, it is frequently overlooked Over half of their patients had been under treatment and some had undergone operations for symptoms which were caused by the nasopharyngeal tumors Other writers have reported similar experiences, proving that the nasopharynx, because of its inaccessibility, is too often neglected The symptoms produced by nasopharyngeal lesions are frequently misleading and seldom do they direct attention to this area except when the lesion is well advanced In Graham and Meyer's series transitional cell carcinomas predominated Twenty-six of the 29 patients were treated by Roentgen therapy, the dosage and method of treatment being described fully Only six of these survived It should be noted that none of these patients was seen early as all had lymphadenopathy on initial examination, an indication of early metastasis It behooves the rhinologist to exercise more diligence in examination of all patients with bizarre symptoms, for only in this manner can an early diagnosis permit a better prognosis

Morrison[72] states that because carcinoma of the pharynx and tonsil is rare and produces minimal symptoms in the early stages, patients complaining of mild, persistent soreness, a burning sensation, mild dysphagia, slight "stuffiness" of the ears or similar symptoms should have careful examination of the entire pharynx with a head mirror, pharyngeal and laryngeal mirrors and the finger A specimen for biopsy should be obtained from any mass, ulcer or area which feels different from the surrounding tissue The prognosis of malignant lesions of the tonsil and pharynx has been rather poor because the diagnosis is usually made in the late stages after metastasis has occurred, however, early adequate treatment of patients with such lesions has given good results Morrison, therefore, emphasizes the dangers of temporizing in such cases

Cruthirds[73] presents a case of an angioepithelioma of the postnasal spaces in a boy four years old One month following removal of the tumor and eight Roentgen ray treatments, the patient appeared normal in every way, however, five months postoperatively there was metastasis to the lungs and abdomen and the patient died

Since most of these tumors do not present symptoms until fairly late, Cruthirds emphasizes the importance of routinely performing a thorough examination of the nasopharynx in any patient with nasal obstruction or pain in the head and neck Only in this way can these tumors be detected early enough, since early treatment with Roentgen ray and radium offers the patient his best chance

Greenfield[74] was prompted to report a plasmocytoma of the nasopharynx because of its rarity He quotes several authors and concurs in their belief that although it is true that extramedullary plasmocytomas may vary greatly as to their malignancy and course, there appears to be little evidence to indicate they are not all malignant lesions and they should be so treated

A case is reported of such a tumor occurring in a soldier 20 years old Intensive million volt Roentgen therapy was given to the recurrent neoplasm in the nasopharynx The cervical nodes responded slowly to irradiation Greenfield states that originally the diagnosis in this case was reticulum cell sarcoma but because of its resistance to Roentgen ray a review of the histologic section was made and the diagnosis changed When accessible, plasma cell tumors may be successfully treated by surgical excision combined with Roentgen ray These tumors are radiocurable, but require intensive therapy to the lesion

In a most thorough and interesting article, Hall and Friedman[75] relate the results of their extensive observations on the histologic changes in squamous cell carcinoma of the mouth and pharynx produced by fractionated irradiation The administration of Roentgen rays in small daily fractions permits the normal epithelium to recover somewhat each day from irradiation injury, whereas the less differentiated tumor cells, for the most part, show no evidence of recovery Fractionation also increases the number of times each tumor cell is exposed to irradiation while in the premitotic or mitotic phase, which is believed by many to be the most radiosensitive phase

The standard treatment technique is accurately described The administration of each daily dose of radiation evokes a companion recovery effect Successive doses of radiation become cumulative in their effect Biopsies were taken at frequent intervals during this entire study to determine the progressive action of irradiation The histologic changes produced in tumor cells following irradiation of squamous cell carcinomas are *1* the acute cell death, which occurs chiefly during the first week of irradiation, *2* the characteristic cell change of enlargement of tumor cells, some of which attain giant size, and *3* radiation keratogenesis, which is the acceleration either in rate or degree of the normal process of keratinization

The observations of Hall and Friedman suggest that as a result of irradiation there is a pattern of progression from normal mitotic figures to giant-sized tumor cells to profound nuclear disturbances In successfully treated carcinoma, mitotic division ultimately ceased

In order to destroy a radiosensitive squamous cell carcinoma of the upper respiratory tract, it is usually necessary to produce at least a second degree epithelitis and epidermitis These reactions of the skin and mucosa are an indication of the amount of destruction produced by radiation and serve as a guide in the treatment of the patient

An analysis of the serial biopsies showed that 25 to 50 per cent of tumor cells were destroyed between the seventh and the eleventh days of irradiation, usually by acute cell death, which is considered the most significant of all radiation effects

This is a most worthwhile paper full of knowledge of the subject and should be read by all referring patients with malignancies for irradiation so that they may have a better understanding of the histologic changes which take place in irradiated tumors

Friedberg[76] contends that the otolaryngologist is directly concerned with lesions which are primarily intracranial and which secondarily involve the nasopharynx or nasal cavities Certain intracranial tumors involving the region of the sella turcica are known to invade the sphenoid sinuses, nasopharynx and nasal passages by direct extension The most common of these are the pituitary adenomas and chondromas The clinical and pathologic aspects of craniopharyngiomas, pituitary adenomas and chondromas are reviewed excellently by Friedberg and their reference to extracranial invasion is discussed Clinical manifestations of headaches, nasal obstruction and excessive postnasal discharge, particularly if this latter is hemorrhagic, should make the otolaryngologist aware of the possibility of extracranial extension of sellar neoplasms True adenocarcinoma of the pituitary may be extremely difficult to distinguish from a primary malignancy of the nasopharynx Biopsy usually establishes the diagnosis and Roentgen therapy has been found to be the best type of treatment The responsibility of the otolaryngologist in these types of cases is obvious Every patient with a known or suspected lesion of the anterior or middle cranial fossa should have a careful nasopharyngeal examination Although it is true that the types of cases reported and so well discussed in this paper by Friedberg are rare, nevertheless such a presentation should be studied by all otolaryngologists

In an excellent article Orton[77] presents the results of his personal experience with 470 cases of carcinoma of the laryngopharynx His results agree with some of our accepted facts about these lesions In his series the most common malignancy of the laryngopharynx was the squamous cell variety and it predominated in males in the proportion 12 to one The surgical indications for the various types of malignancies of the laryngopharynx are discussed Orton correctly advocates radical excision for extrinsic types of carcinoma when operable and expresses the opinion that radiation is of little if any value He further stresses that it is the duty of the surgeon to aid in rehabilitating laryngectomized patients and help them to develop new voices The statistics presented are interesting and informative and should be studied by all doing laryngeal surgery

At periodic follow-up Roentgenologic examination of 195 patients with carcinoma of the hypopharynx, in addition to the usual primary reaction, Welin[78] observed, in five patients, increased width of the prevertebral soft tissue shadow and the recurrence of irregularity of the mucous membrane, changes which were strongly suggestive of a local recurrence, however, these changes disappeared without further treatment and there was no evidence of recurrence on clinical examination Welin suggests that these changes are probably produced by a late reaction after irradiation or they may represent a reaction of the irradiated tissue to some extrinsic insult

In an excellent article based on practical experience and sound reasoning, Lynch[79] reminds us that the nasopharynx is not the area of the upper respiratory tract most frequently invaded by malignancies, but it is one of the most serious sites Lack of early symptoms is probably responsible for failure to make an early diagnosis in so few cases Frequently metastasis occurs before the tumor is of sufficient size to produce symptoms Lesions are most often found on the posterior wall of the pharynx and Lynch considers these malignancies to be much more common than reports in the literature indicate The disease is primarily one of males The pathology, histologic terminology, symptoms and diagnosis are discussed Lynch correctly concludes that the treatment of choice for nasopharyngeal malignancies is radiation

Baclesse and Dulac[80] point out that in cases in which clinical examination of the rhinopharynx proves difficult, radiographic examination of this region will indicate the existence of a tumor and its extent Although lymphosarcomas, epitheliomas and lymphoepitheliomas — the most frequent malignant growths — produce similar shadows, they can often be distinguished by their location For example, epitheliomas of the Eustachian tube have a particular aspect which makes it possible to distinguish them from those arising at the level of the posterior-superior partition The different anatomo radiographic aspects as revealed in the Roentgenogram are discussed

REFERENCES

1 HARRIS, H H Pathologic Conditions of the Nasopharynx, Diagnosis and Treatment *Tex State Jour Med*, 44 368 371, Sept, 1948

2 KOLMER, J A, BONDI, A, JR., and SCHELLINGER, CLARE The Bacterial Flora of the Nasopharynx in Relation to the Common Cold *Arch Otolaryngol*, 45 571 580, May, 1948

3 WOODSON, W B The Mesopharynx in Diagnosis *Trans Amer Acad Opthal and Otol*, 51 477 499, May June, 1947

4 OLDFIELD M C, and MACNAUGHTON, I P J Congenital Abnormalities of the Pillars of the Fauces and the Action of the Pos er or Pillars and Nasopharyngeal Valve During Speech *Jour Laryngol and Otol* 61 594 600, Nov, 1946

5 OLDFIELD, M C Cleft Palate and the Mechanism of Speech *Brit Jour Surg*, 35 173 179, Oct, 1947

6 MACCHARLES, M R Pharyngeal Diverticula. *Manitoba Med Rev.*, 27 333 335 June, 1947

7 MELAMED, A, and WALKER, L J Dissecting (Intramural) Pharyngoesophageal Diverticulum *Rad'ol*, 49 712 716, Dec, 1947

8 SHALLOW, T A., and CLERF, L H One-Stage Pharyngeal Divert'culectomy, Improved Technique and Analysis of 186 Cases *Surg Gynec and Obst*, 86 317-322, Mar, 1948

9 MINO, R A, and MURPHY, A I, JR Diverticula Arising at the Pharyngoesophageal Junction *Del State Med Jour*, 20 75-79, Apr, 1948.

10 TERRY, R N Esophageal Intubation for Repair of Pharyngoesophageal Diverticulum *N Y State Jour Med* 48 1709 1710, Aug 1948

11 FICKLING, B W, and ROWE, N L Packing the Pharynx *Lancet*, 1 573 574, Apr 10, 1948

12 MERKEL B M Foreign Body in the Nasopharynx. *Jour Iowa Med Soc*, 38 247 250 June, 1948

13 FRANKLIN, R H Postcricoid Pharyngoesophageal Perforation *Lancet*, 2 159, July 24, 1948

14 RICHARDSON, E C Hemorrhage from the Internal Carot'd Artery Following Pharyngeal Abscesses *Jour Laryngol and Otol*, 61 604-607 Nov, 1946

15 ROBELEN, H Unusual Retropharyngeal Abscess Complicated by Erythema Nodosum *Clin Proc, Child Hosp*, 4 180 184, June, 1948

16 KORKIS, F B Pharyngeal Abscesses in Young Children *Practitioner*, 161 199 202, Sept, 1948

17 DELL'ABATE, S Sesioni oro-faringee e leucemie acute *Oto-rino-laringol ital*, 15 184,192, Fasc 3, 1947

18 Sharp, H S Pemphigus of Pharynx *Proc Roy Soc Med*, 40 284 Apr, 1947

19 Goldstein, J, and Calcagno, P L Faucial Diphtheria in Adults with Reference to Early Diagnosis Report of Case with Complete Heart Block. *N Y State Jour Med*, 47 1511 1513 July 1, 1947

20 Markham, W M Tuberculosis of the Adenoids *Brit Med Jour* 2 254, Aug 16, 1947

21 Siegel, M The Epidemiology of Acute Respiratory Infections Conditioned by Sulfonamides *Amer Jour Hyg*, 46 149 161 Sept, 1947

22 Spar, A. A., and Williams, H L Osteomyelitis of the Basisphenoid and Basiocciput with Meningitis and Cranial Nerve Palsies as a Complication of Nasopharyngeal Packing for Control of Epistaxis Report of a Case with Recovery *Arch Otolaryngol*, 46 473-477 Oct, 1947

23 Faber, H K, Silverberg, Rosalie, and Dong L Excretion of Poliomyelitis Virus *Proc Soc Exper Biol and Med*, 66 103 104 Oct. 1947

24 Schenck, H P Common Infections of the Pharynx and Fauces *Med Cl n N Amer*, 31 1356 1367 Nov 1947

25 Beck, A. L Deep Neck Infection Submaxillary Type in a Two and One-Half Months Old Infant. The Laryngoscope 57 722 724 Nov 1947

26 Wright, F J Glossopharyngeal Zoster Followed by Varicella in Two Contacts. *Lancet*, 2 946 947, Dec 27, 1947

27 Fox, N Beta Hemolytic Streptococcus Parasitism in Infections of the Upper Respiratory Tract *Arch Otolaryngol* 46 762 772 Dec 1947

28 Mangabeira Albernaz Paulo Classification of Inflammations of the Throat *Arch Otolaryngol*, 46 735 752 Dec 1947

29 Gustafson, W E Preliminary Studies on the Agent of Canine Pharyngolaryngotracheitis *Yale Jour Biol and Med* 20 185-196 Dec 1947

30 Arnaud G Resultats du traitement de 85 cas de pharyngolaryngites tuberculeuses par la streptomycine *Acta oto rhino laryng belg* 2 3 16 Fasc. 1, 1948

31 Wille Camillo A Case of Primary Nasopharynx Tuberculosis *Acta oto-laryng*, 36 61 65, Fasc 1 1948

32 Neiman I S Prophylactic Value of Sulfathiazole An Experiment Designed to Test the Efficacy of Sulfathiazole Gum in Reducing the Bacterial Flora Causing Infectious Pharyngitis *Arch Otolaryngol* 47 158-164, Feb 1948

33 Rosenthal, D B Tuberculosis of the Upper Part of the Respiratory Tract with a Report of a Case *Med Jour Australia* 1 335-337 Mar 13, 1948

34 Ray, B S and Stewart H J Rôle of the Glossopharyngeal Nerve in the Carotid Sinus Reflex in Man Relief of Carotid Sinus Syndrome by Intracranial Section of the Glossopharyngeal Nerve *Surg* 23 411-424 Mar 1948

35 Ravenna, P, and Snyder, J The Occurrence of Edema of the Pharynx and Larynx in Infectious Mononucleosis *Ann Int, Med*, 28 861 865, Apr, 1948

36 Dalton, S E Lymphoid Hyperplasia of the Epipharynx, a New Method for Control *Arch Otol*, 47 611 618, May, 1948

37 Bixby, E W The Effectiveness of Penicillin in the Treatment of Nasopharyngeal Diphtheria *Amer Jour Med Sci*, 215 509 514, May, 1948

38 Rovenstine E A, and Papper, E M Glossopharyngeal Nerve Block *Amer Jour Surg*, 75 713 715, May, 1948

39 McLorinan, H The Use of Tracheotomy in Pharyngeal and Respiratory Paralysis Following Diphtheria and Bulbar Poliomyelitis *Med Jour Australia*, 1 765 766, June 19, 1948

40 Ritter A A New Method of Transverse Pharyngotomy *Jour Laryngol and Otol*, 62 410 416, July, 1948

41 Kilbourne, E D, and Loge J P The Comparative Effects of Continuous and Intermittent Penicillin Therapy on the Formation of Antistreptolysin in Hemolytic Streptococcal Pharyngitis *Jour Clin Investigation*, 27 418 424, July, 1948

42 Keller F T, and Cross R J Pharyngeal Bursitis, a Case Report *Bull School Med Univ Maryland* 33 35 39, July, 1948

43 Wenner, H A, and Tanner, W A Poliomyelitis in Families Attacked by the Disease I—Distribution of Virus in Stool and Oropharynx of Members in Household *Amer Jour Med Sci*, 216 258 269, Sept, 1948

44 Theobald, W H Associated Symptomatology of the Diseases of the Epipharynx *Ann Otol Rhinol and Laryngol*, 57 677 685, Sept 1948

45 Morrison, J T Glossopharyngeal Neuralgia, Extracranial Neurectomy *Brit Jour Surg*, 36 208 209, Oct, 1948

46 Loge, J P, and Kilbourne E D Penicillin Treatment of Streptococcal Pharyngitis *Ann Int Med*, 29 698 711, Oct, 1948

47 Reynaud, J Traitement et prevention de la surdite d'origine tubaire par curiethérapie du rhino pharynx *Ann d'Otolaryngol*, 64 26 39, Jan Feb, 1947

48 Fox, S L The Use of Radium in the Treatment of Adenoid Tissue *Bull School Med Univ Maryland*, 32 30 34, July, 1947

49 Bernstein, B T The Rôle of Radium Application in the Nasopharynx *S African Med Jour*, 21 693, Sept 27, 1947

50 Hall, Colby Radium Treatment of Deafness *Ann West Med and Surg*, 1 271 276, Sept, 1947

51 Crowe, S J Increased Radiation Dosage with the Monel Metal Nasopharyngeal Applicator *Miss Val Med Jour*, 69 127 129 Oct 1947

52 Seedorf, E E and McKay, E D Roentgen Therapy for Lymphoid Hyperplasia of the Nasopharynx *Tex State Jour Med*, 43 457-461, Nov 1947

53 Jennings J L Use of Radium in the Nasopharynx for Deafness and Its Clinical Effects, Report of Cases *Jour Med Assn Ga* 37 21 25 Jan, 1948

54 Scal, J C Radiation Therapy for Prevention of Deafness and Treatment of Upper Respiratory Tract Infections *Eye Ear Nose and Throat Month*, 27 69 71 Feb 1948

55 Fox, S L, and West, G B Jr A Safe and Efficient Cleansing Device for the Nasopharyngeal Radium Applicator THE LARYNGOSCOPE 58 339-340, Apr 1948

56 Jones E H Irradiation of the Adult Nasopharynx THE LARYNGOSCOPE 58 527 541 June 1948

57 Woodbridge C L The Radium Nasopharyngeal Applicator in the Treatment of Hypertrophied Adenoidal Tissue *Ky Med Jour* 41 329 331 Aug 1948

58 Neivert, H and Kallen L A Complete Unit for Use of Nasopharyngeal Radium Applicator THE LARYNGOSCOPE, 58 1162 1164 Oct 1948

59 Minchew B H and Collins B E Radium Irradiation of the Nasopharynx for Hypertrophy of Lymphoid Tissue *Jour Med Assn Ga* 37 439-443 Dec 1948

60 Waltner J G Plasma Cell Tumors of the Nasopharynx *Ann Otol Rhinol and Laryngol* 56 911 916 Dec 1947

61 Koop C E Jordan H E and Horn R C Neurilemmona of the Pharynx. *Surg, Gynec and Obst* 85 641 645 Nov 1947

62 Knight J S and Bunting W P Fibroma of the Trachea *Arch Otolaryngol*, 47 67 70 Jan 1948

63 Diamond E H and Perkins C W Calcified Hematoma of the Oropharynx Secondary to a Gunshot Wound *Arch Otolaryngol* 47 64 66 Jan 1948

64 McFarland J C Retropharyngeal Lipoma Report of a Case *Lancet* 1 327 Feb 28 1948

65 Martin H Ehrlich H E and Abels J C Juvenile Nasopharyngeal Angiofibroma *Ann Surg* 127 513 536 Mar 1948

66 Lillie, H I and Heck, W E Hemangioma of the Lateral Laryngeal Band Report of Case *Proc Staff Meet Mayo Clin* 23 396 400 Aug 18 1948

67 Harkonen M and Malmio K On the Treatment of Nasopharyngeal Fibroma and Its Results *Acta Otolaryngol* pp 33-40 Supp 67 1948

68 Wang Shih Hsun Malignant Tumors of the Nasopharynx *Chinese Med Jour* Chengtu Ed 62A 121 124 Apr 1944

69 Davis E D D The Diagnosis and Treatment of Tumors of the Nasopharynx *Proc Roy Soc Med* 40 707 712 Oct 1947

70 Van Metre T E Jr. Malignant Tumors of the Nasopharynx *Bull Johns Hopkins Hosp* 82 42 55 Jan 1948

71 Graham V P and Meyer R R Experiences with Nasopharyngeal Carcinoma *Radiology* 50 83 91 Jan 1948

72 Morrison L F Cancer of the Tonsil and Pharynx *Calif Med* 68 100 102 Feb 1948

73 Cruthirds, A. E Angioepithelioma of the Postnasal Space *Ann Otol, Rhinol and Laryngol*, 57 230 234, Mar, 1948

74 Greenfield, M M Malignant Plasmocytoma of the Nasopharynx, a Case of Multiple Myeloma Primary in the Nasopharynx *Radiology* 50 661 665, May, 1948

75 Hall, J W, and Friedman, M Histologic Changes in Squamous Cell Carcinoma of the Mouth and Oropharynx Produced by Fractionated External Roentgen Irradiation *Radiology*, 50 318 350, Mar 1948

76 Friedberg, S A Intranasal Extension of Sellar and Parasellar Neoplasms The Laryngoscope, 58 347 373, May, 1948

77 Orton, H B Surgery of Malignant Disease of the Laryngopharynx *Jour Med Soc N J*, 45 430-435, Sept, 1948

78 Welin, S On a Peculiar Late Reaction in Radiologically Treated Cases of Cancer of the Hypopharynx *Acta Radiol*, 30 249 256, Fasc 3 Sept 30, 1948

79 Lynch, M G Malignant Tumors of the Nasopharynx *N Orleans Med and Surg Jour*, 101 165 168, Oct, 1948

80 Baclesse, F, and Dulac, G Le radiodiagnostic des tumeurs malignes du rhinopharynx *Jour de radiol et d'electrol* 29 24-36, No 1 2 1948

SURGICAL PROCEDURES DIRECTED TOWARD THE PREVENTION OF HEARING IMPAIRMENT IN CHILDREN*

PHILIP E. MELTZER, M.D.,
Boston, Mass.

To appreciate fully the problem of the surgeon whose task is to ameliorate or prevent deafness, one must comprehend the complexity of the structures that make hearing possible. Ear surgery is unlike any other type of surgery. The ear surgeon's task is not finished with the closing of the wound; he can leave very little to the natural process of healing. Ear surgery demands an exacting technique as well as an exacting after-care. The ear is a challenge to even the most skilled hands, and the surgeon must not only cure the disease but also must attempt to insure the maintenance of hearing. He must use his skill to leave intact, or as little damaged as possible, the tissues and structures involved in the conduction of sound.

The ear demands of the surgeon, first, that he know the anatomy thoroughly; second, that he understand the pathologic processes that may affect it; third, that he develop manual dexterity to a high order of excellence. These demands upon the surgeon may be fulfilled by apprenticeship and observation, also by practice on the cadaver.

The technique of ear surgery will not be described in detail; rather, an attempt will be made to clarify the conditions when it should be resorted to in the management of ear disease and for the prevention or amelioration of deafness.

---

*Read at the Eighty-second Annual Meeting, American Otological Society, May 19, 1949, New York, N. Y.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Aug. 14, 1949.

In the course of that clarification, there will be indicated what particular surgical procedures are most suited to accomplish these aims in certain given circumstances

THE ROLE OF THE ADENOID IN DEAFNESS

DIRECT ADENOIDECTOMY

It is amazing to note how frequently one observes the presence of a large mass of adenoid in children in whom there has been no history of otitis media of any kind, in spite of the fact that they have had numerous upper respiratory infections It is also amazing to me to have observed the membrana tympani in children with typical signs of tubal obstruction and yet no complaint of the ear and, as far as could be determined, no hearing loss, however, we all know that the most common cause of deafness in children is the presence of adenoid tissue on and around the Eustachian tubes or an extension of an infection into the tube from contiguous infected adenoid tissue When an adenoid mass is present in children with a history of otitis media, whether it be secretory or acute suppurative, the treatment is its surgical removal More debatable is the question, Is surgery indicated in cases where the adenoid mass has already been removed, but there is evidence of regrowth? If the regrowth can be palpated or visualized with a nasopharyngoscope, the answer is emphatically *yes* — and by the technique of *direct adenoidectomy*

What is meant by direct adenoidectomy? Direct adenoidectomy is the complete visualization of the entire nasopharynx, including the fossa of Rosenmuller, the torus of the Eustachian tube and the lateral salpingopharyngeal bands that extend behind the soft palate along the posterior tonsillar pillars Direct visualization of the adenoid is best accomplished with the patient in the sitting position, because the operator is directly in front of the patient, he can work on either side of the nasopharynx without changing his position and this is important if one is to see and treat these least accessible areas In the supine position with the head either flat or hyperextended there is too much tension on the tongue, thereby limiting the mobility of the palate so that it cannot be elevated and retracted properly I have tried the supine position innumerable times and have never found it to be comparable to the sitting position The danger of this position is very effectively minimized by passing an intratracheal tube and packing the hypopharynx with gauze moistened in saline solution Other simple procedures such as the immediate packing of the postnasal space with a large gauze sponge and making firm compression for a minute, this will slow down the bleeding considerably Briskly bleeding vessels are made visible for this technique and can be clamped immediately Compression by the hemostat for a few minutes will assure a completely dry nasopharynx The assistant, all during the operation, constantly sweeps the suction tube across the oropharynx

Although it is not my intent to go into details of any of the surgical procedures for the prevention of deafness, I do believe that this particular operation needs more than mere mention of it by title In the sitting position the patient's head must not lie against the firm headrest but must remain free in the head holder's hands, so that it can be hyperextended and easily rotated Any mouth gag which will not automatically hold the tongue firmly to the floor of the mouth or create tension on the pillars of the tonsil and soft palate can be used to keep the mouth open Minimal tension should be exerted on the tongue in keeping it out of the field of vision A Lothrop palate retractor is used to elevate the soft palate, and by varying the amount of tension on the soft palate with the retractor, almost every part of the vault can be visualized The torii of the Eustachian tubes are readily recognized By placing the lip of the Lothrop retractor behind the torus, with gentle lateral pressure, the fossa of Rosenmuller will be exposed The head holder facilitates this visualization by thrusting the patient slightly forward at the hips and hyperextending the head so that the highest area of the vault may be exposed to view

If the adenoid is being operated upon for the first time the mass is removed with the LaForce adenotome and the bleeding controlled as described Then, by lifting the palate with retractors as mentioned, the remaining lymphoid tissue is removed from the more inaccessible areas, such as the fossa of Rosenmuller, the torr and the salpingopharyngeal bands It is essential that sharp, clean cutting punches be used with a perforated retaining basket This procedure insures removal of practically every bit of visible lymphoid tissue

In patients with regrowth of adenoid, much more meticulous care must be exercised for its removal If there is a large mass present, begin first with the adenotome and then resort to the punches for the more thorough removal of the lymphoid tissue from the torus of the tube and fossa of Rosenmuller In the vast majority of cases, recurring middle ear infection from contiguous tissues will be prevented by this procedure

Is this operation a panacea? Certainly not, but it is the best procedure that I know of and has served me well for many years I have removed adenoid regrowth from children who had previously been given a full course of radium or Roentgen ray therapy, yet suffered recurrent attacks of secretory or acute suppurative otitis media, after this type of surgery no further attacks occurred On occasion I have willingly and happily resorted with excellent results to the use of radium and Roentgen ray in children on whom I performed direct adenoidectomy and failed to relieve them There will always be a few patients in whom otitis media will recur despite surgical or physical therapy

I cannot go along in principle with those proponents of radium or Roentgen ray therapy who substitute it for surgery regardless of the amount of regrowth The use of physical therapy should be limited to patients with persistent recurrence of otitis media who have already had surgery, and in whom the lymphoid tissue is flat and cannot be removed by further surgery Having failed to observe diminution in size of the lymphoid mass, even where the radium applicator was in direct contact with it, you will understand why I prefer surgical removal to physical agents

EARLY MYRINGOTOMY AS A PREVENTIVE PROCEDURE

To even mention myringotomy as a surgical procedure for the prevention of deafness seems elementary and yet it is definitely an important preventive measure Otolaryngologists are seeing fewer and fewer cases of acute suppurative otitis media in children The reason is that the pediatrician or general practitioner sees the patient first, and since the advent of antibiotics both have developed strong resistance to early myringotomy, despite the strongest indications for its performance The fault lies, perhaps, primarily with the otolaryngologists who have not sufficiently emphasized the danger of impaired hearing owing to unresolved exudate in otitis media, exudate that could and should have been drained by myringotomy This is not by way of belittling the effectiveness of the sulfonamides or of antibiotic agents in controlling infection The point is, that to ignore the harmful effect of delayed resolution of exudate on hearing in cases where antibiotics have been used borders on negligence This antipathy to myringotomy by both physicians and parents is most unfortunate, as the price may be some loss of the child's hearing

For that reason I urgently advise early myringotomy where the indications for it are present It is a very important preventive measure and should be resorted to more frequently

SIMPLE MASTOIDECTOMY AS A PROPHYLACTIC MEASURE

There can be no question in anyone's mind about which step to take when, in the course of an acute suppurative otitis media, signs and symptoms of mastoiditis appear, but what about the patient who has had adequate chemotherapy in whom the landmarks of the drum membrane and the hearing fail to return to normal, or where the suppuration is minimal or ceased entirely? This is the type of case where judgment must be used in deciding whether to continue temporizing or to operate Where suppuration has gone on for some time and then ceases, the question is, can the inflammatory reaction of the middle ear structures be resolved to a degree where normal function can be re-established? In other words, is the inflammatory process reversible?

Without going into detail about any given case, I should like to emphasize the importance of not allowing persistent middle ear inflammation and the accompanying deafness to go on unchecked I definitely recommend opening the mastoid and thoroughly exenterating the cells, especially in the region of the antrum for its effect in depleting the middle ear mucous membrane The surgeon must take the initiative in resolving this tug of war between the organism and the therapeutic agent, with the patient taking the worst of it The end-result of prolonged middle ear inflammation, even without suppuration, is in my experience some loss of hearing In operating on these patients you will be amazed at the degree of decalcification and often suppuration, where chemotherapy and antibiotics have been used unsuccessfully

AMELIORATION OF DEAFNESS IN MICROTIA

Microtia occurs in a relatively small number of children, but when it does exist, particularly when bilateral, the surgeon must take some steps to help the child learn speech so that he may be properly educated A special surgical procedure has been developed that can improve the child's hearing and bring it to a practical level

In these children the auricle is grossly malformed and the external osseus canal as well as the membrana tympani is absent The ossicles are generally rudimentary or poorly developed, and may be fused, the stapes is usually normal In approximately one-half the patients the antrum and mastoid may be well developed Where the cellular development is good, an operation described by Pattee[1] has succeded in restoring hearing to practical levels

The following is a brief outline of the procedure The posterior root of the zygoma is the most important landmark and generally indicates where the antrum may be opened so as to expose the epitympanum and middle ear space An incision is made over the area where the antrum is expected to be and the mastoid cortex removed A conical exenteration of the cells is carried out with the apex toward the antrum The lateral semicircular canal is readily identified, the incus and malleus are then exposed Instead of following the Pattee technique of leaving only a small opening to the antrum, Dr Edgar A Holmes, of the Massachusetts Eye and Ear Infirmary, who performs these operations, on my suggestion, now enlarges the antrum considerably and removes the malleus and incus, thereby exposing the head of the stapes A skin graft is pressed into the bony cone-shaped cavity, with the apex of the graft directly in contact with the stapes This acts as an excellent conductive mechanism to the movable stapes

This modified Pattee technique is a useful surgical procedure for the alleviation of deafness in certain severely handicapped children For the deformity, the plastic surgeon may utilize one of several corrective techniques at his command

CONSERVATION OF HEARING IN CHRONIC SUPPURATIVE OTITIS MEDIA

In a previous paper titled "Hearing in Chronic Otitis Media," I discussed the various operative procedures wherein the hearing might be conserved I did not have in mind children in particular As this present paper deals entirely with children, there are several factors which should be clarified

The paramount objective in the management of chronic suppurative otitis media has always been, and still is, to eradicate the focus of infection which may be a threat to life Other considerations were that suppuration had to be eliminated, and if possible, hearing conserved The saving of life made the other two desired objectives negligible The frequency of chronic suppurative otitis media in clinics and in private practice has diminished tremendously in the past 10 years No longer do we see children in whom the drum membrane and the ossicles disappear in a matter of days in the course of an acute scarlet fever or influenzal infection There are areas in this country where prompt and adequate medical care is not yet available and I presume we will continue to be confronted with the sporadic case of chronic suppuration in children These patients will require the best of judgment and skill in eliminating the disease and, at the same time, conserve hearing

In children where the disease is limited to the epitympanum or antrum and the mucous membrane of the middle ear is simply thickened, the hearing very often is good If before operation the parents are informed that an attempt is being made not only to eradicate the disease but also to conserve hearing, and that there may be a slight discharge from the ear following the operation, I am sure they will be happy to concur with the surgeon's wishes in order that the residual hearing may be saved

Before entering into further discussion regarding surgical procedures, I must bring to your attention the excellent paper read before this Society in 1938 by Dr J Morrisset Smith, wherein he described what he called "a graduated surgical technique" requiring only the complete simple mastoid operation in some cases or, where necessary, other more extensive surgical procedures Dr Smith's approach to the problem of the chronic suppurative ear is well planned and logical My own approach varies somewhat in that it attempts to accomplish the desired result either by way of the external canal or by the Lempert endaural technique I use the endaural technique entirely for modifications of the radical as well as the complete radical operation

OSSICLECTOMY

In children with chronic suppurative otitis media where the drum membrane is practically absent with only remnants of the ossicles present, ossiclectomy is my first preference These cases are not commonly seen and, therefore, the oppor tunity for the use of this procedure is limited It should be performed only in such cases where the Roentgen ray shows no evidence of enlargement of the antrum by either cholesteatoma or necrosis of cells In other words, the operation is performed only where the disease is limited to the epitympanum and ossicles It should not be attempted where granulations or polypi fill the middle ear space or where the external canal is too small to permit good instrumentation It should never be performed in a patient with a history of acute exacerbations or where symptoms are suggestive of serious complications

Ossiclectomy has fallen into disuse chiefly because the patients were not well selected and the procedure carried out without visualizing the cutting edge of the instruments This resulted in damage to the membranous canal and middle ear mucous membrane and, not infrequently, to the facial nerve All cutting is toward the operator and away from the medial wall of the tympanum All instruments are of special design, particularly the bone cutting forceps They must be sufficiently slender to pass through an ear speculum and still permit visualization of the cutting edge

The operation includes the removal of what remains of the drum membrane and ossicles and the lateral epitympanic wall formed by the inferior surface of the squama as it fills in the notch of Ravinius Dr George L Tobey[3] re-emphasized the usefulness of this operation in 1930 He advocated in a paper read before this Society, the removal of the lateral epitympanic wall so that the anterior end of the lateral semicircular canal could be seen This gave an excellent view of the entire middle ear and tympanic space This simple operation often results in a dry middle ear with preservation of the residual hearing

The after-care of these cases is simple cleansing of the middle ear by irrigation with 10 cc of peroxide diluted with equal parts of 70 per cent alcohol These agents will wash out inspissated blood and debris The middle ear may then be dusted with one of the following powders *1* Sulzbergeriodine powder 2 Combination of the following powders urea, 50 per cent, boric acid, 35 per cent, sulfanilamide, 13 per cent, sulfathiazole, 2 per cent If the powder fails to dry up the ear, a culture will reveal whether the organisms are susceptible to penicillin or streptomycin These agents may be used in combination penicillin, 5,000 units per cc, and streptomycin, 25 mg per cc The ear is first cleansed with peroxide and alcohol solution, dried, and then five drops of this combined penicillin-streptomycin solution is instilled into the external canal and allowed to remain for five minutes so as to permeate the recesses of the ear

EXTENSIVE SIMPLE MASTOIDECTOMY

Where perforations of either Shrapnell's membrane or the membrana tensa are small, and the hearing is excellent, one may consider performing an extensive simple mastoidectomy as a preliminary procedure in the attempt to obtain a dry ear and conserve the hearing This operation should include the exposure of the head of the malleus and incus, the removal of all granulations in the region of the antrum, as well as the exenteration of the perilabyrinthine cells Smith advocates irrigation for several days to thoroughly cleanse the antrum and epitympanic region This type of operation, if not successful, results in recurrent postaural abscess with continuation of the discharge In the event of a recurrent postaural abscess, although simple incision and drainage is all that is necessary, the frequency of these recurrences distresses the child and parents very much, and they are likely to demand more permanent relief

THE MODIFIED RADICAL FOR CONSERVATION OF HEARING

This procedure may be resorted to when more conservative measures such as the extensive simple mastoidectomy has failed It may be performed in those patients with large perforations of Shrapnell's membrane, with or without cholesteatoma The operation is effective in patients with posterior superior marginal perforations where the disease is entirely limited to structures of the epitympanum, antrum or mastoid There is no point in performing a modified radical mastoidectomy unless the hearing is worth conserving It has been my practice to perform the modified mastoidectomy without the preliminary use of the extensive simple mastoidectomy even in children The exteriorization of the epitympanic space, antrum and mastoid not only prevents possible recurrence of postaural infection and other otitic complications but affords good access for the after-care of the cavity

The extent of the disease determines the actual surgical technique Where, for example, the ossicles appear normal or simply enveloped by thickened membrane, they need not be removed, they are left *in situ* If the head of the malleus and the incus appear to be necrotic they should be removed

The modified radical has come into its own since Lempert advocated the endaural approach for the eradication of disease of the temporal bone The controlled instrumentation permits exposure of the malleus and incus without destroying their relationship This approach has improved the chances for conserving hearing to a much greater degree than any other technique

The modified radical should include the complete removal of the outer epitympanic wall and the widening of the notch of Rivinius Thus, the head of the malleus and incus will be widely exposed for good inspection of the recesses of the epitympanum Where the head of the malleus or incus is necrotic and it becomes necessary to remove them, the medial wall of the epitympanum is thoroughly curetted and a skin graft is placed in such a manner as to seal the middle ear space The inferior margin of the graft overlies the upper part of the membrana tensa for about 1 mm It is surprising how well hearing is maintained in spite of the removal of the incus and the head of the malleus One would expect a severe drop in hearing, at least a 40 to 50 db loss, but where the stapes is freely movable and contained in a sealed tympanic space, I have observed practical serviceable hearing in these patients Air-borne sounds are apparently conducted to the head of the stapes with very little loss, a fact borne out by the work of Bekésy

If there is a large perforation of Shrapnell's membrane, so that the ossicles cannot be covered, it may be necessary to leave the head of the malleus and incus exposed as in a *bas relief* The membranocutaneous canal wall is preserved and is used to cover the ridge as well as part of the mastoid cavity The remaining portions of bare bone, such as the tegmen, may be skin grafted immediately Although I have left the malleus and incus exposed in the epitympanum without covering them, I now do so with a small primary skin graft The result has been very satisfactory

COMPLETE RADICAL MASTOIDECTOMY

Generally speaking, when one performs a complete radical mastoidectomy in children it is because there is extensive erosion by cholesteatoma, or a marked infection of the middle ear mucous membrane with granulations and polypi, or there are threatening symptoms which require the disregardance of conserving any useful hearing When the complete radical mastoidectomy is to be performed by choice, the hearing should be good enough to warrant leaving the mucous membrane intact over the promontory and the windows There is no point in trying to conserve very limited hearing if by doing so you sacrifice the opportunity to eradicate completely the disease, wherever it may be

The important point that I wish to bring out in the performance of the complete radical operation, if hearing is to be conserved, is that the mucosa of the medial tympanic wall—namely, that over the promontory and the regions of the oval and round windows—must not be disturbed One must use the gentlest of suction in these regions, even better would be the gentle absorption of blood with cotton wound applicators If suction is preferred, the finger must not be placed over the opening of the tube Violent suction does as much harm as rough instrumentation If there are small, movable granula tions about the window they can be removed with specially designed middle ear curettes In my experience the complete removal of the mucosa from the medial tympanic wall has always resulted in a further loss of hearing Skin grafting of the tympanum proper in the complete radical operation has also resulted in further loss of hearing

SUMMARY

The most important surgical procedure for the conservation of hearing in children is, in my opinion

1 A well done adenoidectomy The well done adenoidectomy can best be accomplished by the direct visualization of the vault

2 Myringotomy — which is a simple and very effective surgical procedure for prevention of deafness and should always be performed when indications are present in spite of the use of chemotherapeutic drugs and antibiotic agents

3 In children with chronic middle ear suppuration where hearing is present, every attempt to conserve that hearing should be made by utilizing one or the other of the various simple or more radical procedures known to us, such as the extensive simple mastoid operation, the modified radical or the complete radical, without disturbing the middle ear mucous membrane

REFERENCES

1 Pattee, George L *Arch Otol* 45 568 580 May 1947

2 Smith J Morrisset The Laryngoscope 48 499 509 July 1938

3 Tobey George L *Trans Amer Otol Soc* 20 140 1930

CARDIOVASCULAR EPISTAXIS AND THE NASO-NASOPHARYNGEAL PLEXUS *

GEORGE H WOODRUFF, M D ,
Joliet, Ill

In 1942, the type of nasal hemorrhage associated with hypertension and arteriosclerosis was described by the author,[1] and it was further asserted that this variety of nasal hemorrhage seemed to be a distinct clinical entity The purpose of this article is to reassert this belief in the light of further experience and to describe a group or plexus of blood vessels which may be frequently involved in cardiovascular epistaxis

The history alone will usually aid greatly in differentiating cardiovascular epistaxis from the other frequent variety of spontaneous epistaxis, the common nose bleed of Kieselbach's area, sometimes called epistaxis digitorum The latter usually has a history of repeated minor bleedings over quite a period of weeks or months, gradually increasing severity as the minor trauma which caused it goes on In contrast, the onset of cardiovascular epistaxis is usually sudden and severe, with a copious gush of blood from the nose or into the nasopharynx The initial flow may cease spontaneously as the blood pressure is lowered, only to recur in a few hours as the pressure again rises This sequence usually repeats itself several times, the patient meanwhile suffering more and more from loss of blood

Epistaxis digitorum may occur at any age, but is more apt to occur in young adults and in children than in middle-aged or elderly individuals Cardiovascular epistaxis, on the other

---

*Submitted as Candidate's Thesis to the Laryngological Rhinological and Otological Society Inc 1949

Editor's Note This ms received in Laryngoscope Office and accepted for publication July 28 1949 hand, is an affliction of the middle-aged and elderly The youngest patient in a series of 28 cases presented was 41 years of age

Epistaxis digitorum occurs usually in individuals with a normal blood pressure, while in the cardiovascular type the pressure is nearly always distinctly elevated

TABLE 1

SUMMARY OF DATA ON PATIENTS IN WHOM BLEEDING OCCURRED IN THE LATERAL WALL OF THE INFERIOR MEATUS FAR BACK

No	Name	Age	Blood Pressure	Location of Bleeding	Treatment
1	Mrs J	69	180/110	Lat wall inf meatus far back	Tamponage successful
2	Mrs W	73	216/110	Lat wall inf meatus far back	Tamponage successful
3	P M 1st time	55	215/110	Lat. wall inf meatus far back	Tamponage successful
4	P M 2nd time	56	210/110	Lat wall inf meatus far back	Tamponage successful
5	Mrs S	73	185/100	Lat wall inf meatus far back	Tamponage successful
6	T C	60	170/110	Lat. wall inf meatus far back	Tamponage successful
7	J M	72	188/104	Lat wall inf meatus far back	Tamponage failed in presence of deflected septum Ligation ext carotid successful
8	O S	74	210/110	Lat wall inf meatus far back	Tamponage failed in presence of deflected septum Ligation ext carotid stopped bleeding Pt died suddenly apparently from an embolus
9	B E	52	220/110	Lat. wall inf meatus far back	Tamponage failed in presence of deflected septum Ligation ext carotid successful
10	Mrs R.	40	135/90	Lat wall inf meatus far back	Tamponage successful
11	Mr C	51	220/120	Lat wall inf meatus far back	Tamponage successful
12	Mrs W	58	200/90	Lat wall inf meatus far back	Tamponage successful
13	H R 1st time	65	210/100	Lat wall inf meatus far back	Tamponage failed in presence of deflected septum Ligation ext carotid successful
14	S S	65	220/110	Lat wall inf meatus far back	Tamponage successful

The location of epistaxis digitorum is almost invariably in Kieselbach's area, while the location of cardiovascular epistaxis may be anywhere in the nasal cavity It seems to have a distinct tendency to occur outside the strict confines of Kieselbach's area The most frequent single site in the 28 cases presented was in the lateral wall of the inferior meatus far back, as is shown in Table 1 Fourteen of the 28 hemorrhages occurred in this area Other sites were the septum, just above and posterior to Kieselbach's area, an area high up and far back in the nasal cavity, the lateral wall in front of

TABLE 2

SUMMARY OF DATA ON PATIENTS IN WHOM THE SITE OF HEMORRHAGE WAS IN OTHER AREAS

No	Name	Age	Blood Pressure	Location of Bleeding	Treatment
1	Mrs B	75	165/100	Lat wall inf meatus half way back	Tamponage successful
2	Mrs L	76	190/100	Septum posterior to and above Kieselbach's area	Electrocauterization successful
3	Dr Mc	70	210/110	Posterior portion nasal cavity, high up	Tamponage between sept and middle turbinate, back, successful
4	Mrs W	68	200/100	Posterior portion nasal cavity high up	Tamponage between sept and middle turbinate, back, successful
5	W S	68	175/90	Kieselbach's area	Electrocauterization successful
6	M B	60	195/90	Kieselbach's area and above, general oozing	Tamponage successful
7	M W	63	205/95	Bleeding not accurately located	Bleeding stopped after p ing nose twice
8	C J	58	205/110	Bleeding not accurately located	Postnasal pack inserted b resident, bleeding stoppe
9	H R 2nd time	68	205/100	Septum posterior to and above Kieselbach's area	Electrocauterization successful
10	C L 1st time	50	190/95	Septum near Kieselbach's area	Electrocauterization successful
11	C L 2nd time	51	190/95	Lat nas wall near ant end mid turb	Electrocauterization successful
12	M M	56	195/95	Kieselbach's area	Electrocauterization successful
13	C D	51	180/90	Kiselbach's area	Electrocauterization successful
14	Mrs J	65	210/110	Behind and above Kieselbach's area	Electrocauterization successful

the anterior end of the middle turbinate, and Kieselbach's area proper The distribution is shown in Table 2 In two cases the location of the bleeding was not definitely established

It appears to me that the points just presented are sufficient not only to differentiate cardiovascular epistaxis from epistaxis digitorum but they also argue quite definitely that cardiovascular epistaxis is a distinct clinical entity

There are, of course, instances in which repeated digital trauma and cardiovascular disease co-exist and share in the etiology of nasal hemorrhage In such a case Kieselbach's area will sometimes show evidences of long continued minor trauma In pure cardiovascular epistaxis the bleeding point is often a little posterior and above Kieselbach's area It seems probable that in the presence of hypertension, when the bleeding point is in Kieselbach's area proper, the bleeding may have a dual etiology

It does not appear that there should be any difficulty in distinguishing cardiovascular epistaxis from the rare varieties of spontaneous nose bleed such as heredoangiomatosis and the various diseases of the blood which interfere with the formation of a normal blood clot

As my interest in this subject went on, I began to study the nasal cavity with the nasopharyngoscope, not only in patients who had had this type of hemorrhage but also in routine examinations It was found that in many people there was a group or plexus of rather large blood vessels in the lateral wall of the inferior meatus well posteriorly (see Fig 1) These vessels appear to come from the lateral pharyngeal wall and run forward to a point under the overhang of the inferior turbinate body where they become deeper and are lost to view There is considerable variation in these vessels In some people, particularly in the young, they are very small and not at all prominent In others, particularly in some people of middle age or older, they are more numerous, quite large and often appear dilated The appearance of these vessels suggests that they are veins rather than arteries, though there are probably arterial vessels accompanying them at a slightly greater depth

Because of their location in the exact area where bleeding is most frequently found, it seems quite probable that cardiovascular epistaxis often comes either from these dilated veins or from arterial vessels which may lie slightly deeper

The name, naso-nasopharyngeal plexus, has been suggested by the author for this group of vessels because they lie partly in the nasal cavity and partly in the nasopharynx

The lateral wall of the inferior meatus of one patient was observed with the nasopharyngoscope just after bleeding had temporarily stopped A portion of a blood vessel about three-eighths of an inch long was seen to be empty of blood, and it resembled a capillary glass tube in appearance It was in the area of the naso-nasopharyngeal plexus

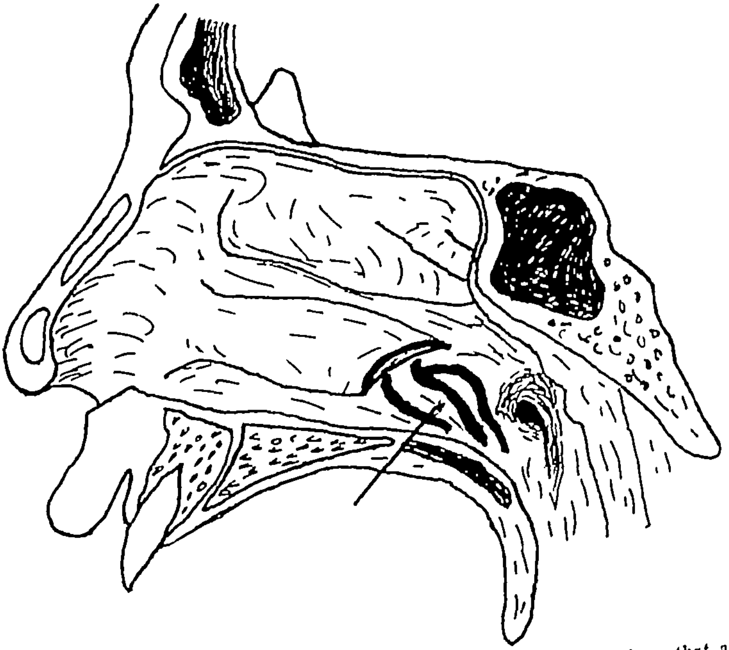


Fig 1 Posterior end of inferior turbinate amputated to show that an area of frequent hemorrhage in cardiovascular epistaxis is the same area in which a prominent group of blood vessels the naso nasopharyngeal plexus ' is often found

In many people with advancing years the veins become diseased as well as the arteries, and phlebosclerosis is perhaps as common as arteriosclerosis, although it is often passed over or neglected It may be that some of the severe hemorrhages come from diseased veins which usually lie more superficially than do the arteries Also, cases have been described by Friedberg[3] and others in which the superior vena cava was severely constricted by a neighboring tubercular process, resulting in impeded circulation in the head and neck as well as in the upper extremities Bleeding from the nasal cavity occurs in these cases

The treatment of cardiovascular epistaxis depends upon its location Consequently the first step is to locate the site of the ruptured vessel as accurately as possible If it is Kiesselbach's area or some other spot well anterior, the exact bleeding point can be well visualized and exactly located In such a case the electrocautery has been the agent of choice in my hands and it has been effective Electrocoagulation should work equally well An alternative method would be the use of a sclerosing agent, such as sylnasol, though I have not tried it in this type of bleeding

When the hemorrhage comes from the posterior part of the nose or even high up anteriorly, it is sometimes very difficult to locate its origin accurately Obviously local anesthesia and decongestion of the nasal membranes are essential in locating the site of the hemorrhage and in treating it after it is located Suction is of great aid in removing blood as fast as it appears Gross clots and pools of blood should be expelled by the patient by clearing the throat and blowing the nose before attempting localization

When the ruptured vessel is in the extreme posterior portion of the lateral wall of the inferior meatus it is obviously impossible to locate it with exactitude and electrocoagulation and electrocauterization are very difficult to carry out without damaging considerable uninvolved mucous membrane The method which I have favored has been given the name "precision packing" or "precision tamponage " Solutions of tannic acid and antipyrine have been found to be valuable in carrying out this tamponage A rather firm tampon slightly larger than a lead pencil and about two inches long is fashioned out of long fibre cotton A small amount of 4 per cent aqueous antipyrine solution is poured into a medicine glass and an equal amount of a 4 per cent aqueous solution of tannic acid is added There results a rather heavy rubbery precipitation into which the tampon is plunged It is then inserted into the nose with a bayonet type dressing forceps and is wedged firmly and with considerable pressure into the angle between the lateral nasal wall and the overhang of the inferior turbinate Two or three more such tampons are inserted to fill the inferior meatus and to insure firm pressure on its lateral wall, especially in its posterior portion One more dry tampon is usually wedged firmly between the inferior turbinate body and the nasal septum to hold the other packs in position The tampons are inserted just far enough so that the posterior tips just reach the choana An excellent precaution to keep the tampons from slipping backward is to tie a piece of suture material to the anterior ends and fasten them to the cheek, though I must admit that I have used them without the suture safeguard and have never had one slip backward The tampons are usualy left in place for five days, but if they loosen in three or four days, as sometimes happens, the loosened ones are then removed In my experience, if bleeding can be completely arrested for five days, sufficient healing takes place so that the result is permanent

Unfortunately in the presence of a deflected septum of any considerable degree, tamponage of the inferior meatus may be very difficult or even impossible to carry out effectively In such a case, if the bleeding is close enough to, or in the choanal opening, it may be controlled by drawing a pack forward into the choana and nasal cavity from the pharynx, thus making direct pressure on the bleeding area The so called Bellocque pack described by Waldapfel[1] may be used for this purpose Additional packing may then be placed against this choanal plug through the anterior nares If the bleeding point is in the nasopharynx, a postnasal pack should prove effective, but I do not favor postnasal packs if the bleeding area is within the confines of the nasal cavity As a general rule I feel there is no excuse for massive packing of the nasal cavity except possibly as an emergency measure

Bleeding from the area between the posterior portion of the middle and superior turbinates on one side and the lateral nasal wall on the other just anterior to the sphenoid sinus may be controlled by using cotton tampons and the antipyrine tannic acid mixture Two such cases were encountered and were successfully handled in this manner Woodward and Holt[5] found soluble gauze valuable in the treatment of some cases of epistaxis

It is sometimes very difficult to localize a bleeding point when the bleeding is very profuse and also when the bleeding has completely stopped At times, if you are lucky enough to see such a case when the bleeding is only slight or moderate in amount, it is quite a help and, in many cases, the bleeding will vary greatly in amount from time to time When searching for a bleeding point when the bleeding has temporarily stopped, sometimes a very small nipple shaped elevation may be found The elevation is almost invariably the site of the break in the involved vessel, and if there is any doubt, the slightest touch on the suspicious point will re-establish the flow of blood

In four cases the external carotid artery was ligated when other methods failed to control the bleeding In three of them a deflected septum made it very difficult to use tamponage effectively Three of the patients were in other cities where they could not be kept under very close observation They had already bled for a long time, and I felt that it was wise to ligate the external carotid In all four cases the bleeding was successfully controlled

The patient's general condition must be observed closely, and whole blood should be given whenever the blood loss has been very great It may be safer to give small amounts rather frequently than to give 500 or 1,000 cc at one time

Other causes of hemorrhage must be kept in mind because cardiovascular hemorrhage may be aggravated by various abnormalities of the blood and blood clotting mechanisms which should be treated as indicated

Sedatives and hypnotics may be given, but over-sedation and hypnosis should be avoided because in this state it may be possible for a patient to swallow rather large quantities of blood without being aware of it

When other methods have been given an adequate trial and fail to control the bleeding, ligation of the external carotid or possibly the internal maxillary artery should be carried out If cardiovascular hemorrhage should come from the extreme upper anterior portion of the nasal cavity there might arise an indication to ligate the anterior ethmoidal and possibly the posterior ethmoidal artery This could be carried out through a Jansen-Lynch orbital approach, such as is used in operations on the frontal and ethmoid sinuses

It is recognized that in cases of severe hypertension and arteriosclerosis, nose bleed may be of temporary benefit, but in many individuals the bleeding continues far too long or recurs too often The lowering of blood pressure incident to epistaxis is transient and the treatment of the cardiovascular disease should be placed in the hands of an internist

SUMMARY AND CONCLUSIONS

Twenty-eight cases of cardiovascular epistaxis have been studied

They appear to have special characteristics that make this type of hemorrhage a distinct clinical entity

The most frequent location of the bleeding is in the lateral wall of the inferior meatus far back

A group or plexus of blood vessels found in the above area is described and the name naso-nasopharyngeal plexus is suggested

Various methods of arresting cardiovascular epistaxis are discussed and a method of tamponage of the inferior meatus which has usually proved successful is described in detail

In cases which resist other methods of control, ligation of the external carotid artery is advocated without too much delay

BIBLIOGRAPHY

1 Woodruff, G H Nasal Hemorrhage in Hypertension and Arteriosclerosis. *Dis Eye, Ear, Nose and Throat* 2 236 Nov 1942

2 Woodruff, G H Posterior Nasal Hemorrhage *Arch Otolaryngol* 46 421-422 Sept 1947 (Abstract) *Ann Otol Rhinol and Laryngol* 56 490-491 June 1947 (Abstract)

3 Friedberg, S A. Hemoptysis Secondary to Chronic Mediastinal Venous Obstruction. *Ann Otol, Rhinol and Laryngol* 57 897 909 Sept 1948

4 Waldapfel, R. Nasal Hemorrhage in Daily Practice *Rocky Mt Med Jour*, 42 835-837 Nov 1945

5 Woodward F D and Holt .T Otolaryngological Use of Soluble Gauze *Arch Otolaryngol* 47 155-157 Feb 1942

We were able, in our small series, to verify Lederer's findings, and to supplement his classification by the addition of fibroma as a more mature polyp An increase in the connective tissue which is present in all polypi results in fibroma

In an acute exacerbation of a middle ear infection, there is an increase in the polymorphonuclear leucocytes within all types of aural polypi, together with ulceration and increase in abscess formation within the growth Since granulation polypi spring from the subepithelium, they are indicative of osseous necrosis The fact that they seldom originate from the promontory is another indication that this osseous mass is not susceptible to infections

Tumarkin[1] stresses the importance of conservative treatment for aural polypi, stating that radical surgery is rarely indicated Besides the use of caustics, he advises unipolar, bipolar and ordinary zinc ionization

While trite, all papers on this subject should warn surgeons to avoid the evulsion of growths in the middle ear The reason is self-evident Biting forceps should cut cleanly and snares function properly to avoid a possible catastrophe This could occur even in as simple a procedure as removing tissue for biopsy

While one sees many cases of chronic otitis media, relatively few cases present the picture of new growths within the middle ear, therefore, the series presented in this paper is small—too small for the establishment of conclusive results

RADIATION

With no precedent to follow, the dosage and type of radiation for use in the external auditory canal and middle ear had to be established

In the treatment of the 10 cases listed in this article, the nasopharyngeal radium applicator was used This applicator consists of approximately 50 mg of radium contained in a Theringion glass tube 0 27 mm thick and surrounded by monel metal 0 33 mm thick Seventy-five per cent of the hard beta rays are absorbed The radium is 2 mm from the end of the applicator, which is an obvious disadvantage Further filtration could eliminate practically all the beta rays Since the nasopharyngeal applicator was available, it was thought advantageous to use it rather than design a new applictor, although that could easily be devised

It as felt that the ideal dose was that amount of radiation necessary to bring about the desired result without damage to the tissue It was impossible to estimate that dose using the nasopharyngeal applicator containing 50 mg of radium, for three reasons *1* no similar treatment had been reported with this applicator, *2* the skin of the external auditory canal being thin, it was thought to be unusually susceptible to radiation reactions, *3* the question of cartilage damage had to be considered In order to evaluate a safe dose, a series of normal patients was treated with the applicator inserted into the external auditory canal with doses varying from 30 seconds to 15 minutes In over 100 control patients, no erythema could be seen after 10 to 15 minutes of treatment, therefore, a maximum dose of 12 minutes was established in all cases None of the patients has shown any evidence of erythema or skin irritation

The use of radiation for chronic granulation tissue is well known The rationale for treatment in the middle ear is the same as that in other parts of the body The concept that aural polypi, chronic granulation tissue and fibroma are different states of the same process would lead one to assume that if radiation is beneficial in one stage, it might be in another McKee and Cipollaro[3] state, "The effect of radiation is closely related to the degree of leucocytic infiltration, the rate of cellular hyperplasia, the known sensitiveness of lymphocytes and the degree of proliferation of connective tissue" Desjardin's[1] classical work on the sensitiveness of different tissues has enabled us to predict with some accuracy the reaction to be expected In chronic granulation, the radiation undoubtedly affects the leucocytic infiltration and the cellular hyperplasia just as it does in other parts of the body

TABLE II FOLLOWING RADIATION

Name Age Sex	Elapsed Time Since Last Treatment	Secretion of Middle Ear	Growth of Middle Ear	Hearing Loss	End-Result
Ear No 1 R P, 36, female	1 year	Dry	Totally absent	Mixed deafness average 30 db	Excellent
Ear No 2 R P, 36, female	1 year	Dry	Totally absent	Mixed deafness, 60 db	Excellent
Ear No 3 B L B, 9, male	8 months	Drainage continues	Much smaller	Conduction deafness, 7 db	Poor
Ear No 4 E M H, 44, female	9 months	Slight drainage	Lining membrane appears normal	Mixed deafness, 10 db	Good
Ear No 5 E M H, female	6 months	Moderate drainage	Totally absent	Mixed deafness, 35 db	Good
Ear No 6 L D, 36, male	9 months	Dry	Totally absent	Conduction deafness, 0 db	Good
Ear No 7 K W, 19, female	8 months	Profuse drainage	Slightly smaller	Record lost	Poor
Ear No 8 S W 19 male	No follow up	No follow up	No follow up	No follow up	No follow up
Ear No 9 B C, 14 female	15 months	Drainage continues	Granulations absent—lining membrane thickened	Conduction deafness 10 db	Good
Ear No 10 H K 23 male	4 years	Dry	Lining membrane practically normal	Mixed deafness average 5 db	Excellent

Excellent—denotes a dry ear with complete disappearance of growth
Good—denotes a moist ear with complete disappearance of growth
Poor—denotes growth still present with drainage

TREATMENT

The polypi and fibromas were removed surgically as completely as possible, which allowed the insertion of the applicator to the base of the polyp or the fibroma Radiation was applied to the base of the lesion three to six days later when the young, sensitive fibroblasts were more active This was similar to the effective treatment of keloids or polypi in other parts of the body

With the patient in a reclining position and the diseased ear exposed, the external auditory canal and the middle ear were thoroughly cleansed The radium applicator was then passed through the external auditory canal into the middle ear adjacent to the growth The applicator was held in place by the use of cotton packed into the external auditory canal and auricle

Audiographs of each patient were taken before and after radiation therapy Cultures and biopsies of the middle ear secretions and tissue were made when feasible A Roentgenogram of the paranasal sinuses was made, and of the mastoids, when indicated

No patient, after a treatment, was given subsequent radiation until 30 days had elapsed

The tables give complete information in a concise manner in each of these cases A total of 10 ears is reported In addition to the cases listed in the tables, we have used radiation with the 50 mg radium applicator for the removal of granulation tissue in the middle ear following two endaural radical mastoidectomies and one simple mastoidectomy with excellent results

CONCLUSIONS

1 Fifty mg of radium as shielded in the nasopharyngeal applicator can be safely used in the middle ear

2 This therapy is correlated with radiation of similar tissues in other parts of the body

3 In the two cases whose end-results were classified as poor, the growths, after treatment, showed definite evidence of atrophy

4 The effect of radiation on the infection undoubtedly played some part in healing these lesions

5 The results, even in this small series of cases, are indicative of the merits and rationale of radiation in selected cases of middle ear disease

BIBLIOGRAPHY

1 Desjardins, A U Action of Roentgen Rays or Radium on Inflammatory Processes *Radiol*, 29 436, 1947

Desjardins, A U Radiosensitiveness of Cells and Tissues *Arch Surg*, 25 926, 1932

2 Lederer F L Clinical Significance of Aural Polyps *Arch Otolaryngol*, 33 1008 1027, June, 1941

3 MacKee, George M, and Cipollaro, Anthony C X rays and Radium in Treatment of Diseases of the Skin Philadelphia Lea & Feb'ger, 1946

4 Tumarkin, A Clinical Note on Aural Polypus *Jour Laryngol and Otol*, 52 681 684, Oct, 1937

IRRADIATION THERAPY OF FENESTRATION AND RADICAL MASTOIDECTOMY CAVITIES*

G. O'NEIL PROUD, M.D., and THEODORE E. WALSH, M.D.,
St. Louis, Mo.

One of the most troublesome phenomena which confronts the otologist is the appearance and persistence of granulation tissue and discharge in the postoperative radical mastoidectomy or fenestration cavity. There is little doubt that the endaural approach, magnification technique, and application of skin graft to the cavity have enabled the aurist to do a much more thorough exenteration of the diseased bone, and a dry, well epithelialized cavity is more easily obtained. Nevertheless, granulations do form in some cases. Meticulous postoperative cleansing, curettement of granulations, cautery and antiseptic drops or powders are frequently sufficient to produce a dry cavity, but some cavities continue to form granulations and discharge persists in spite of these measures.

It is the purpose of this paper to present the evaluation of another procedure, Radium Irradiation Therapy, as an adjunct to the older methods of postoperative care.

Other investigators have advocated the use of irradiation in troublesome postoperative cavities. Goosman[1] reported 10 cases and Ersner and Weiner[2] 15 cases successfully treated with X-ray when ordinary therapy failed to rid radical mastoid cavities of granulations and discharge. Keeler[3] advised the use of radium and reported success in three cases.

---

*From the Department of Oto-Laryngology of the Washington University School of Medicine, St. Louis, Mo.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication July 15, 1949.

SELECTION OF CASES

All postoperative fenestration and radical mastoidectomy cases which exhibited discharge and excessive granulations in the cavities were seen biweekly and received the following regimen

1 Careful dry wipes

2 Removal of exuberant granulations with the curette

3 Cauterization of small granulations with a concentrated solution of trichloracetic acid

4 Insufflation of boric acid powder or a combination of zinc peroxide, sufanilamide and sulfathiazole powders

5 Instruction to the patient to instill a solution of 5 per cent boric acid in 70 per cent alcohol into the ear twice daily

Thirty cases, 17 radical mastoidectomies and 13 fenestrations, which did not respond to this therapy were chosen for irradiation When radium treatments were started the above measures were discontinued

MATERIAL AND TECHNIQUE

The irradiation was given with the standard 50 mgm radium sulfate applicator as described by others[1-3] for use in the irradiation of nasopharyngeal lymphoid tissue The cavity was carefully dry wiped with cotton applicators and the radium applicator was then placed in contact with the area of granulation tissue and left in position for 12 minutes Three such treatments were given at weekly intervals and the patients were observed one week, two weeks, one month, and two months after the third treatment

RESULTS

The value of the therapy was estimated as follows *1* Good, complete disappearance of all granulation tissue, and cessation of discharge *2* Fair, partial disappearance of granulations, and complete cessation of discharge or complete disappearance of granulations with diminution of discharge *3* The result was recorded as poor when granulations and discharge were unchanged

TABLE 1

Case No	Type of Procedure Done Prior to Irradiation	Length of Time Between Surgery and Irradiation	Result
1	Three simple Mastoidectomies and two Radical Mastoidectomies	One year nine months	Good
2	Radical Mastoidectomy	Eight months	Good
3	Fenestration	One year	Good
4	Radical Mastoidectomy	Fourteen months	Good
5	Fenestration	Eleven months	Good
6	Fenestration	Two years three months	Good
7	Radical Mastoidectomy	Eighteen months	Good
8	Radical Mastoidectomy	One year	Fair
9	Fenestration Bilateral	Seven months	Fair
10	Fenestration	Two years three months	Fair
11	Fenestration and Revision	One year	Good
12	Fenestration	Eighteen months	Good
13	Radical Mastoidectomy	Six months	Fair
14	Radical Mastoidectomy	Seventeen months	Poor
15	Fenestration	Two years nine months	Fair
16	Radical Mastoidectomy	Nine months	Fair
17	Radical Mastoidectomy	Fourteen months	Good
18	Radical Mastoidectomy	Seven months	Poor
19	Fenestration	One month	Good
20	Fenestration	Three months	Good
21	Radical Mastoidectomy	Ten months	Poor
22	Radical Mastoidectomy	Fourteen months	Good
23	Radical Mastoidectomy	Two years	Poor
24	Fenestration	Eleven months	Good
25	Radical Mastoidectomy	Three years	Fair
26	Fenestration	One year	Good
27	Radical Mastoidectomy	Four months	Poor
28	Radical Mastoidectomy	Three months	Good
29	Radical Mastoidectomy	Two years	Good
30	Fenestration	Thirteen months	Fair

The individual cases were summarized as follows

TABLE 2 TOTALS

Procedure	Number	Good	Fair	Poor
Radical Mastoidectomy	17	8	4	5
Fenestration	13	9	4	0
Total	30	17	8	5

DISCUSSION

It is interesting to note that the response to radium was slightly better in the fenestration cases It is felt that the osteitis in the cases of radical mastoidectomies might account for the relatively larger number of failures or partial successes From Table 1 it is evident that the length of time which the granulations and discharges had been present had little to do with the response to irradiation One case did not respond although it was only of four months' duration, while another responded very satisfactorily after a duration of 21 months No untoward results were noted following experimental therapy There was no deterioration of hearing following radiation Naturally, one is curious as to why the cases show improvement subsequent to irradiation Three possibilities present themselves

1 The irradiation exerts a specific destructive influence upon the granulation tissue

2 The infection in the cavity is eradicated in some way by the irradiation, and the disappearance of the granulations is a secondary phenomenon

3 The irradiation is both bactericidal and destructive to the granulations

It is well known that tissues which are poorly differentiated and embryonic in type respond more readily to irradiation than do more highly differentiated tissues It would follow that granulation tissue, which consists mostly of young fibroblasts and capillaries, should be quite radiosensitive

Three observers[9] have produced convincing evidence that radium emanations exhibit a definite bactericidal effect *in vitro* The reasons for this effect have received much discussion Two theories have been proposd to explain the lethal action of radioactive rays on *in vitro* cultures of streptococcus and staphylococcus the chemical hypothesis states that the death of the cells is due to chemical changes within the cell set off by contact of the radioactive emanations with intracellular substances, the second theory is known as the "lethal mutant theory" and holds that death of the bacteria is due to mutation produced within the cell following irradiation In support of this theory is the fact that the irradiated cell usually lives and undergoes division Each of the new formed cells, however, promptly dies Spencer[10] feels that the beta ray is the one which is lethal to the bacteria

The possibility that the irradiation is both destructive and bactericidal is but conjecture In any event, improvement occurred in 25 out of 30 cases in this series, and since the nasopharyngeal radium applicator is now available to many otologists, its use in stubborn cases is warranted, however, the use of radium should be reserved for only those cases which do not respond to ordinary office care

SUMMARY

1 Some radical mastoidectomy and fenestration cavities continue to fill with excessive granulation tissue and discharge in spite of the most meticulous postoperative care

2 The use of the nasopharyngeal radium applicator in such cavities is helpful in some instances

3 The results of radium treatment of excessive granulation tissue and discharge in 30 fenestration and postoperative radical mastoidectomy cases are presented

4 Reasons for success and failure are discussed

BIBLIOGRAPHY

1 GOOSMAN, CHARLES Treatment of Postoperative Mastoiditis with X ray *Jour Radiol*, 3 273, July, 1922

2 ERSNER, M S, and WEINER, L H Roentgenotherapy in Otorrhea Following Radical Mastoidectomy *Med Rec*, 140 588 591, Dec, 1934

3 KELLER, J C Observations Made on 560 Operated Mastoids *Tran Amer Otol Soc*, 18 135 170, Dec, 1928

4 BURNAM, C F, and CROWE, S J Monel Metal Radium Applicator Designed for Maximum Use of Hard Beta Rays in Treatment of Nasopharyngeal Hyperplastic Lymphoid Tissue *Miss Val Med Jour*, 67 109 111, Oct, 1945

5 FISHER, G E Use of Radium and Roentgen Rays in Treatment of Hyperplastic Lymphoid Tissue *South Med Jour*, 39 565 570, July 1946

6 SMITH, J W Use of Nasopharyngeal Applicator *Jour Ark Med Soc*, 43 94 96, Sept, 1946

7 PROCTOR, D F Radiation Therapy (Using Radium Emanation) for Removal of Adenoid Tissue *Arch Otolaryngol*, 45 40-48, Jan, 1947

8 GILLESPIE, C E Use of X ray and Radium in Otolaryngology (Especially Radium Treatment of Hyperplastic Lymphoid Tissue) *Tran Indi Acad Ophthal and Otolaryngol*, 29 48-59, 1946

9 LEA, D E, HAINES, R B, and COULSON, C A Mechanism of the Bactericidal Action of Radioactive Radiations *Proc Roy Soc* 120 47, Apr, 1936

10 SPENCER R R The Sensitivity, in Vitro, of Bacteria to the Beta and Gamma Rays of Radium *Pub Health Rep of Washington* 49 183, 1934

THE EFFECTIVENESS OF DRAMAMINE IN RELIEVING THE VESTIBULAR REACTIONS FOLLOWING THE LABYRINTHINE FENESTRATION OPERATION*

EDWARD H. CAMPBELL, M.D.,
Philadelphia, Pa.

In the April 8, 1949, issue of *Science* there appeared two articles on the use of a new antihistamine drug, Dramamine brand of dimenhydrinate, in the prevention and treatment of seasickness or motion sickness which has stimulated a great deal of interest and has suggested the possibility of expanding the usefulness of this drug to a variety of conditions. Gay and Carliner[1] reported the results of a thoroughly controlled investigation of the use of Dramamine, first on the personnel aboard the U.S.S. America during the summer of 1948, and a few months later on the personnel on board the troop transport U.S.A.T. General C. C. Ballou. On board the troop transport there were 1,366 men, and of these, during the short voyage in rough weather, there were 319 cases of seasickness treated with Dramamine. Complete relief was obtained in 311, or 97.4 per cent. The authors concluded that "the accumulated data indicate that Dramamine is a powerful nontoxic, prophylactic and therapeutic drug, which can be used to control the symptoms of seasickness."

In a preliminary study, Strickland and Hahn[2] reported the effectiveness of the drug in the control of airsickness. Their tests were conducted at the School of Aviation Medicine at Randolph Field, Tex., and 216 subjects were used. One-half

---

*From the Department of Otolaryngology of the Graduate School of Medicine of the University of Pennsylvania.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication July 15, 1949.

venous fluids After operation the position that is most comfortable for the patient and least conducive to vertigo and nausea is the flat position on the side opposite the one operated upon The routine administration of 2 000 cc of glucose and saline solution intravenously by the slow drip process starting immediately after operation further tends to lessen the equilibrium disturbance The choice of sedatives used postoperatively may also influence the nausea Morphine may aggravate the reaction, and individual idiosyncrasies to certain drugs may be present Some surgeons use certain special drugs which are thought to exert a favorable influence on postoperative nausea

In all patients subjected to the fenestration operation it is to be expected that they will experience some degree of postoperative vertigo, nausea and vomiting because of the opening of the vestibular mechanism There is a variation in the degree of sensitivity of the equilibrium apparatus of different persons so that one may naturally experience a profound postoperative vertigo reaction and another, with a less sensitive mechansm, may have but little equilibrium disturbance The average operated patient, however, will experience considerable vertigo, nausea and vomiting with considerable, often violent, nystagmus in spite of such relieving influences as proper position, intravenous fluids and ordinary medication

In order to evaluate properly the effect of any special medication on the postoperative vertigo, nausea and vomiting of patients subjected to the labyrinth fenestration operation it is necessary to establish a standard of such reactions that would normally occur without such special medication Such a standard of reactions is believed to have been set up by the author in the careful postoperative observation of a large number of fenestrated patients who have received identical preoperative medication, practically identical operative anesthesia, the same operative technique and exactly the same postoperative care

The preoperative medication has consisted of three grains of nembutal 10 hours before operation, three additional grains of nembutal one and one-half hours before operation and a hypodermic injection, one-half hour before operation, of one-quarter grain of morphine sulphate and 1/150th grain of scopolamine. The operative anesthesia in practically all cases has consisted of light nitrous oxide and oxygen inhalation throughout and local infiltration of the operative area with 1 per cent procaine solution containing a few drops of adrenalin. In an occasional case the anesthesia has been supplemented by a small amount of sodium pentothal intravenously or a very small amount of ether. The operative technique has been essentially the one described by Lempert with a few minor changes. The fenestra has been created with as little saline douching of the area and as little manipulation of the membranous labyrinth as is consistent with thorough removal of endosteal remnants and bone chips. In all cases the tympanomeatal flap has been sealed firmly in position by either small rolls of paraffin mesh gauze or small pieces of cellulose sponge. The postoperative care consists in the placing of the patient in the recumbent position or on the side opposite the ear operated, the administration of 2,000 cc. of 5 per cent glucose and normal saline solution intravenously over a period of about nine hours and the administration of one grain of codeine sulfate hypodermically as needed for discomfort. It is seldom that the codeine is required during the first 12 hours after operation. Within two hours after operation the patients have aroused sufficiently from their preoperative medication and anesthesia to become fairly alert and to seek the most comfortable position in bed and inquire about the operation.

Under the conditions as outlined above, the postoperative reactions have been surprisingly uniform and can be standardized as follows:

On the day of operation (operation finished at approximately 10:30 A.M.), the patient suffers extreme vertigo and nausea, he prefers the position on the side opposite the operated ear with his eyes closed and vomits frequently through the day spontaneously and practically always when disturbed He refuses all food and only the occasional patient can retain water by mouth As soon as the patient recovers from the influence of the preoperative sedation and the anesthetic (about two to three hours after completion of the operation), severe nystagmus can be observed, often violent in degree During the evening of the first day the patient's vertigo and nausea are somewhat improved but the vertigo continues to be severe and vomiting is apt to occur several times On the following day, the vertigo, nausea and vomiting are somewhat reduced but the average patient will continue to have severe vertigo and will move in bed as little as possible to avoid severe nausea and vomiting The nystagmus continues to be exaggerated Approximately half the patients, on this day, are unable to retain sufficient water by mouth to meet liquid requirements and a second intravenous infusion of 2,000 cc of glucose and saline is necessary The other half retain, with difficulty, sufficient water by mouth during the day, but vomit two to six times Only the occasional patient can take liquid diet with no vomiting and rarely does a patient wish to have his head elevated On the next day, 48 hours after operation, the vertigo and nausea have subsided sufficiently to permit some elevation of the head and the retention of liquid diet and occasionally soft diet Vertigo of a moderate degree, however, is still present and only an occasional patient will wish to sit up in bed and move freely Nystagmus is still present to a moderate degree On the following day the patient is out of bed (with help) for the first time and may take a few steps from the bed to a chair Soft diet is then taken and although there is moderate vertigo still present, there is little or no vomiting Thereafter the patient moves around gradually, and is able to take care of himself sufficiently at the end of six or seven days after operation to be discharged from the hospital

Considering the severe equilibrium disturbances which these patients undergo, causing three or more days of acute discomfort, it is only natural that medicinal agents that might offer any hope of relief would be tried Noting the effect which the drug Dramamine had on patients suffering with seasickness, as recorded by Gay and Carliner,[1] it was thought the drug would have a similarly helpful effect on the very similar symptoms occurring after the labyrinth fenestration operation The drug was tried, therefore, in a series of 28 patients who received the fenestration operation under exactly the conditions as outlined above

The Dramamine administered was in the form of tablets, each containing 100 mg of the drug In nearly all the cases the tablets were given by mouth, but in the later cases, because of the fact that sometimes the first and second doses were vomited, the first two doses were given per rectum The general plan of administration was to give the first dose consisting of two tablets (200 mg) immediately after the patient was returned to bed from the operating room (between 11 and 11 30 A M) and the subsequent doses (each 100 mg) were given at three-hour intervals for four doses, making a total of 600 mg on the day of operation The last dose was given at approximately 11 30 P M and at that time a hypodermic injection of 1 gr of codeine was given and the patient not disturbed through the remainder of the night On the next day one tablet of Dramamine (100 mg) was given by mouth every three hours for six doses, starting at 8 A M The administration of the drug was not resumed on the third or subsequent days unless the vertigo became worse again, and this occurred only in a few instances In the later operated cases the first dose of Dramamine and occasionally the second dose were given per rectum and certain advantages of this method over the oral route were found For the first dose the two tablets of Dramamine were crumbled up in 15 or 20 cc of water and injected into the rectum through a small syringe After the first or second dose of the drug had been given, there was no difficulty in giving the subsequent doses by mouth as the patient by that time had become sufficiently alert to cooperate and in practically all cases could retain the tablet without vomiting

The postoperative care of these 28 patients who were given Dramamine was exactly the same as given the numerous patients who were operated previously and whose reactions serve as a standard of comparison The 2,000 cc of 5 per cent glucose and saline solution was routinely given intravenously and the patient permitted to take the position in which he was most comfortable

The effect of the Dramamine in controlling the vertigo, nausea and vomiting of these 28 operated cases is recorded in Table 1

COMMENT

Observation of the postoperative reactions of these 28 patients who received Dramamine following the fenestration operation indicates that all of them were relieved of the vertigo, nausea and vomiting to a large extent Some of them were sufficiently improved so that they could leave their beds on the day after operation, could drink liquids freely and could take soft diet Others, while comfortable in a quiet position, became moderately dizzy on movement and preferred to stay in bed for another day In none of the 28 patients was there any vomiting on the day following the operation or on subsequent days, although there was some nausea in a few of the patients

It was noted that the nystagmus present in the patients usually closely paralleled the nausea and vomiting — that is, when marked nystagmus was present the nausea was severe and vomiting might be frequent, however, it was observed also that in several of the patients some nystagmus persisted for several days without the amount of vertigo and nausea that one usually associates with such a degree of nystagmus

In general, the relief of the postoperative symptoms by the use of the drug was not as great on the day of operation as on the following day as compared with operated patients who did not receive Dramamine In the latter group, on the day after operation, there was, as an average, considerable nausea and some vomiting, while in the group who received Dramamine there was only slight nausea and no vomiting Greater relief on the day of operation might perhaps have been anticipated in the group receiving the drug, considering the rather large dosage given in a comparatively short time In some cases the first dose of 200 mg was lost or partly lost as the result of vomiting, however, in those patients who received the first two tablets by rectum there was, on the whole, no more relief of the symptoms than in those patients who were given the drug by mouth If it were possible to modify the drug so it could be used by hypodermic injection, a more efficient and consistent result might be anticipated

In only one patient was the Dramamine given as a prophylactic and this patient did not show less vertigo and nausea than the general average of the cases who did not receive the drug until after the operation It may be possible that the hypnotic and sedative drugs given before operation have some antagonistic effect on the Dramamine to lessen or delay its action The author intends to use the drug as a prophylactic with and without preoperative sedation and with various hypnotics and sedatives, in another series of cases, to note any change in the postoperative relief of nausea and vomiting

The prompt beneficial effect of the drug was particularly noticeable in those patients who showed relapses a day or two after the tablets had been discontinued The vertigo and nausea of these patients promptly subsided when the Dramamine was again given, often within an hour after the first tablet was swallowed Several of the patients asked that the tablets be continued regularly to prevent vertigo and nausea

A rather surprising feature, in the observation of these cases, was the fact that in nearly all cases there was no recurrence of the vertigo and nausea on the day following the discontinuance of the Dramamine In the average case not given the drug after operation there is moderate vertigo and some nausea on the third and even fourth days In these 28 cases the Dramamine was given only on the day of operation and on the following day It might be thought that the action of the drug would be worn off by the third day and the patient return to the state of moderate vertigo and nausea that the average untreated patient experienced This was found not to be the case, however, as the great majority of the treated patients did not experience near the vertigo and nausea on the third and subsequent days as did the untreated cases

Close observation on the degree of drowsiness the treated patients experienced was not made The impression is gained, however, that this antihistamine drug caused little or no drowsiness It is my custom in all the fenestration cases to give routinely for three or four days a mild to moderate dose of a hypnotic each night at bed time and a hypodermic of codeine as needed for discomfort The patients, therefore, have some reason to be drowsy at times from the effects of these drugs It can be stated that the depression and drowsiness of the treated patients was certainly no greater than in the untreated patients and it is my impression that the treated patients were more alert than the others on the day following operation, largely perhaps because they were less dizzy and nauseated

TABLE 2

Summary of the Effectiveness of Dramamine in Relieving the Postoperative Vertigo, Nausea and Vomiting of Fenestrated Patients

Number of patients treated with Dramamine	28
Number of patients markedly relieved	8
Number of patients considerably relieved	9
Number of patients moderately relieved	11
Number of relapses after Dramamine was discontinued	8
Number of relapses fully relieved by further administration of Dramamine	8

CONCLUSIONS

In the observation of these 28 patients who received Dramamine on the first two days following the labyrinth fenestration operation it was noted that a moderate improvement of the postoperative vertigo, nausea and vomiting resulted on the day of operation and that a considerable lessening of those symptoms occurred on the day after operation over the severe vertigo, nausea and vomiting of fenestrated patients who did not receive the drug The treated patients were able to go back to a normal diet approximately two days sooner than the untreated cases, could become physically active much sooner and, when they desired, were able to be discharged from the hospital one or two days earlier Considering the small number of patients observed, the features recorded are impressions rather than dogmatic conclusions and further observation of numerous cases will be necessary to establish definite facts on the effectiveness of the drug on fenestrated cases Its use will be continued in other series of cases, both as a prophylactic and therapeutic agent, administered in a variety of ways and coincidently with the various hypnotics and sedatives commonly used preoperatively in patients undergoing the fenestration operation

SUMMARY

1 Recent reports of the effectiveness of Dramamine in controlling seasickness and airsickness have suggested the possibility of relieving or preventing the vertigo, nausea and vomiting experienced by patients who have undergone the labyrinth fenestration operation for otosclerosis

2 A standard of the degree of such postoperative symptoms has been established in the observations of the reactions of a large number of fenestrated patients

3 The postoperative vertigo, nausea and vomiting of 28 fenestrated patients who were given Dramamine during the day of operation and the day following were carefully observed and compared with the established normal reactions of untreated fenestrated patients

4 These observations have shown that the Dramamine treated patients experienced a moderate reduction of the postoperative symptoms on the day of operation over the un-

treated patients and a considerable lessening of these symptoms on the day following operation

5 A chart has been prepared showing the degree of vertigo, nausea, vomiting and nystagmus of the 28 fenestrated patients treated with Dramamine, on the day of operation, on the day following operation and subsequently These reactions are shown in comparison with those of untreated patients

6 Comments and impressions are recorded from the observations made on this series of operated cases

REFERENCES

1 GAY L N, and CARLINER P E The Prevention and Treatment of Motion Sickness I—Seasickness *Sci* , 109, Apr 8, 1949

2 STRICKLAND, B A, and HAHN, G L The Effectiveness of Dramamine in the Prevention of Airsickness *Sci* , 109 359, Apr 8, 1949

269 South 19th Street

IDIOPATHIC SUPRAORBITAL NEURALGIA

T E BEYER, M D ,
Denver, Colo

Idiopathic supraorbital neuralgia is not a rare condition It is a disease of adult life, males being more often affected than females There is apparently no seasonal influence Noteworthy is the fact that many patients give a history of having been treated at intervals for sinus disease

Idiopathic supraorbital neuralgia, by definition, has no demonstrable etiology One may postulate that exposure to cold induces a neuritis and swelling within the supraorbital notch just as thermal changes affect the facial because of its exposed position, however, this is a presumption only which requires more proof before being generally accepted

The cardinal symptom of idiopathic supraorbital neuralgia is pain referred along the terminal ramifications of the ophthalmic branches of the trigeminal This pain is often sharp, twinging and intermittent, usually unilateral, and followed at intervals by a dull throbbing headache In contrast to the pain observed in acute sinusitis, which appears in the forenoon and usually lasts only a few hours, the pain in idiopathic supraorbital neuralgia may continue all day without respite The "trigger zones" of tic douloureux cannot be elicited

The second distinctive symptom of idiopathic supraorbital neuralgia is tenderness of the supraorbital and frontal nerves In the absence of other diagnostic criteria accountable for

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication Aug 29 1949

pain along the distribution of these nerves, this sign alone is pathognomonic

In evaluating this sign it must be remembered that the normal nerves are almost insensitive to pressure In fact, in most instances they can be rolled under the thumbnail at will In contrast, the swollen and inflamed nerve is exquisitely sensitive Even the slightest pressure may cause the patient to literally jump out of the chair with pain

A further precaution is not to confuse hyperesthesia of the nerves in the supraorbital area with the bone pain that characterizes frontal sinus disease In the latter the point of tenderness is confined to a small area on the floor of the sinus, below the supraorbital rim, directly above the inner canthus of the eye

The diagnosis of idiopathic supraorbital neuralgia is not difficult The most common error is to confound it with acute sinusitis This is excusable as both disease entities may present the same syndrome, hyperesthesia, and pain limited to the distribution of the peripheral nerves supplying the frontal area, however, careful rhinological examination and X-rays should obviate such mistakes In doubtful cases several days of observation will divulge the correct diagnosis

The treatment of idiopathic supraorbital neuralgia by alcohol injection is simple and uniformly efficacious The injection is best made with a five-eighths inch, 25 gauge needle fitted to a 2 cc syringe

The hands of the operator and site of injection having been thoroughly sterilized, the right nerve is firmly fixed at the notch with the thumbnail of the left hand The needle is then slid along the surface of the nail through the skin and subcutaneous tissue until it strikes the nerve Instant excruciating pain attests that the point of the needle has penetrated the nerve substance This must be followed at once by the injection of three to five drops of absolute alcohol

It is of the utmost importance that the nerve structure be infiltrated with alcohol Injections made alongside are of little avail, furthermore, the preliminary injection of novocaine increases the difficulty of locating the nerve and is, therefore, contraindicated

In many cases the frontal branch lying nearer to the midline must be injected in a similar manner, but it has never been found necessary to cut down upon and resect a portion of the nerve

Alcohol infiltration of nerve tissue is a momentary painful experience Fortunately, it is followed almost immediately by a feeling of numbness which extends over the parietal region to the occiput Palpation proves that the nerve has lost its sensitiveness The patient is quite relieved of pain

A late effect of alcohol nerve injection is often an extreme, alarming swelling of the upper lid The eye may be closed for several days but untoward complications have never been noted

SUMMARY AND CONCLUSIONS

Idiopathic supraorbital neuralgia is a common disease entity which may closely simulate acute sinus disease

Pathognomonic is the hyperesthesia of the supraorbital and frontal nerves

In the absence of signs and symptoms indicative of sinus disease, this sign alone suffices to make the diagnosis

Alcohol injection is a simple and safe procedure, welcomed especially by patients who have been treated at length for sinus disease

227 16th Street

RECURRENT PNEUMOCOCCUS MENINGITIS
REPORT OF A CASE*

MORRIS DAVIDSON, M D , and ARTHUR M ALDEN, M D ,
St Louis, Mo

Prior to the advent of the sulfonamide compounds, the mortality rate from pneumococcic meningitis approached 100 per cent Finland,[1] *et al*, reported 99 cases of pneumococcic meningitis occurring at the Boston City Hospital from November, 1929, to June, 1936, with no recoveries

Following the introduction of the sulfonamide drugs to general use, numerous cases of recovery have been reported [2] In addition, several instances of recurrent pneumococcic meningitis have been reported

Craddock and Bowers[4] cite their case of a 32-year-old Negro female with recovery after four attacks in one year In this case the mode of entry for the organisms was not determined Hopkins,[5] *et al*, reported three attacks of pneumococcic meningitis in a period of four months in a 30-year-old female The original attack followed an upper respiratory infection

Labby[6] has reported 14 attacks in a 55-year-old male in a period of one year with recovery Traut[7] has described the case of a seven-year-old girl who suffered five attacks of pneumococcic meningitis in a four-year period Traut's patient suffered the first episode of meningitis two and one-half years after an uncomplicated skull fracture

---

*Department of Otolaryngology Washington University School of Medicine

Editor's Note This ms received in Laryngoscope Office and accepted for publication Sept 12 1949

CASE REPORT

A 59-year-old white female entered Barnes Hospital on Jan. 25 1944 in coma. About 36 hours before admission she complained of pain in her right ear and a fever Twelve hours later she noted that the right ear had begun to drain and with this she felt improved for a short period During the night before admission the patient slept poorly and in the morning she was in marked coma.

For several weeks prior to admission to the hospital the patient had been treated by her local physician for effusion of the right ear

On admission the temperature was 104 3° F pulse 100 respirations 26 blood pressure 160/70 The patient was in marked coma the legs and thighs were flexed The neck was stiff Kernig s and Brudzinski s signs were positive The right ear canal contained thick yellow white discharge. A blowing systolic murmur was heard at the apex of the heart. Breathing was shallow but lungs were clear to percussion and auscultation.

A lumbar puncture performed immediately revealed viscid milky fluid The cell count was 2 300 cells without acid and 2 150 cells with acid The Pandy test was positive protein 560 mgm per cent sugar 10 mgm. per cent Wassermann was negative Mice inoculated with cerebrospinal fluid and ear exudate revealed a Type 25 pneumococcus Spinal fluid pressures could not be obtained because the patient became restless and began to toss in her bed when this procedure was attempted. Other laboratory data red blood count 4 010 000 with 11 7 gm Hb white blood count, 19 550 with 68 segmented cells 14 lymphocytes five monocyte and 13 stab and juvenile forms the urine contained two plus albumin the Kahn test was negative

The patient was given 2 gm. of sulfadiazine every four hours and continued on sulfadiazine therapy throughout her hospital stay

X ray Report There is haziness over the entire cellular structures of the right mastoid. The trabeculae appear somewhat thickened Mastoid structures on the left appear to be within normal limits An ear nose and throat consultant (A. M A.) saw the patient the third hospital day and found the right membrana tensa to be dull thick and macerated. A simple mastoidectomy was performed at once The lateral sinus was explored and found to be normal The mastoid was quite sclerotic throughout. No breaks or dehiscences into the dura were found at surgery

On the sulfadazine therapy the patient s postoperative course was uneventful and the patient gradually improved She was discharged on Feb 10 1944

The patient had no symptoms referable to her ears or to her meningitis for five years then on March 27 1949 while at the theatre the patient complained of moderate pain in the right ear Several hours later the right ear began to drain pus and the patient felt more comfortable On awakening the following morning she complained of generalized headache and began to vomit. Two hours after awakening the patient was comatose On admission to the hospital on March 29 1949 the patient was comatose and tossing about in bed The neck was rigid Kernig s and Brudzinski s signs were positive The Babinski sign was negative The right membrana tensa was quite red and a small posterior inferior perforation was seen. The right ear canal was reddened and filled with serosanguinous fluid The lungs were clear to percussion and auscultation. The heart rhythm was regular

Spinal puncture was performed at once and revealed 800 cells Type 13 pneumococcus was recovered Red blood count was 4,400,000 with 14 3 gm Hb , white blood count was 8,600 with 61 segmented forms 28 stab cells, five lymphocytes, five monocytes and one juvenile form, the urine contained three plus albumin

The patient was given 1 000,000 units of penicillin intramuscularly every three hours, in addition to 1 gm of sulfadiazine every four hours Two days after admission the patient was rational and her temperature was normal Her improvement was rapid and she was discharged on April 7, 1949 Five months after discharge she is well and free of symptoms

SUMMARY

A case of recurrent pneumococcic meningitis of otitic origin is presented The second attack of meningitis occurred five years after the initial episode Sulfadiazine therapy and mastoid surgery effected recovery with the first episode, and sulfadiazine and massive doses of penicillin resulted in recovery with the second attack

BIBLIOGRAPHY

1 Finland, Maxwell, Brown, John W , and Rauh, Albert E Treatment of Pneumococcic Meningitis *N Eng Jour Med*, 218 1033 1044 1938

2 Williams, Henry L , *et al* Otitic Meningitis The Laryngoscope, 52 835 869, Nov , 1942

3 Hodes, Harold, Smith, Margaret H D , and Ickes, Howard J Sixty Cases of Pneumococcic Meningitis Treated with Sulfonamide *Jour A M A*, 121 1334 1337, Apr , 1943

4 Craddock, George B , and Bowers, Russell V Recurrent Pneumococcic Meningitis Treated with Sulfapyridine *Jour A M A*, 116 296 298, Jan , 1941

5 Hopkins, Henry, Hatch, L C , Schenck, H P , and Peller, D S Recurrent Pneumococcic Meningitis Treated with Sulfonamide *Ann Int Med*, 20 333 339, 1944

6 Labby, Daniel H Recurrent Pneumococcic Meningitis Following Sulfonamide Therapy *Jour A M A*, 127 981 984 Apr , 1945

7 Traut, Eugene F Recurrence of Pneumococcic Meningitis *Jour A M A*, 129 273 274, 1945

HEARING FOUNDATION ESTABLISHED

Hearing Foundation, a new organization to cope with the social and psychological problems of the hard of hearing, has been formed by the hearing aid industry, it was announced by Fred J Davis, president of the International Hearing Aid Association S Richard Stern, New York public relations counsel, has been named director of the new nonprofit organization, which will have the twofold purpose of alleviating public prejudice toward wearers of hearing aids, and of educating the hard of hearing to the important advances in hearing aids and to the modern rehabilitation techniques

The Foundation is being supported by voluntary contributions from the entire industry, including hearing aid dealers, manufacturers of aids, component parts and batteries, and has the endorsement of key figures among the hard-of-hearing group as well as leading medical and social welfare authorities

Plans for the Foundation include the immediate launching of a public relations campaign with three objectives overcoming public prejudices, educating the hard of hearing to the important advances in hearing aids and the modern rehabilitation techniques, and developing an even greater awareness of all engaged in the industry to the public service aspects of their business

In addition to its broad objectives, the Hearing Foundation plans to establish the "Hearing Advancement Awards" to go to those doing outstanding work in benefiting the hard of hearing, and to establish scholarships for the advanced study of hearing problems Also planned is the "Children's Better Hearing Program," which seeks to gain more attention and assistance for the 300 000 hard-of-hearing children in the country The Foundation will also campaign to eliminate job discrimation in industry and to correct working conditions injurious to hearing

The campaign plans include the dissemination of information about hearing and hearing problems through all possible media, as well as the establishment of a speakers' bureau, utilization of pamphlets, slide films and similar educational techniques The program will also be carried through institutional type ads run by local organizations, in which the various facts will be given to the public

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1949

Acousticon Model A-100

Manufacturer Dictograph Products Corp , 580 Fifth Ave , New York 19, N Y

Aurex (Semi-Portable) , Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp , 1117 N Franklin St , Chicago, Ill

Beltone Mono-Pac , Beltone Harmony Mono-Pac , Beltone Symphonette

Manufacturer Beltone Hearing Aid Co , 1450 W 19th St , Chicago, Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl., New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co , Inc , 10 East 43rd St , New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co , Inc , 50 W 29th St., New York 1, N Y

Maico Type K , Maico Atomeer

Manufacturer Maico Co , Inc , North Third St., Minneapolis, Minn

Mears Aurophone Model 200 , 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp 1 W 34th St New York, N Y

Micronic Model 101 (Magnetic Receiver)

Manufacturer Micronic Co , 727 Atlantic Ave , Boston 11, Mass

Microtone T-3 Audiomatic, Microtone T-4 Audiomatic, Microtone T-5 Audiomatic
Manufacturer Microtone Co, 4602 Nicollet Ave Minneapolis 9 Minn

National Cub Model, National Standard Model, National Star Model
Manufacturer National Hearing Aid Laboratories 815 S Hill St. Los Angeles 14 Calif

Otarion Model A-1, Otarion Model A-3, Otarion Models A-4 J and S, Otarion Model E-1, Otarion Model E-1S, Otarion Model E-2, Otarion Model E-4
Manufacturer Otarion Hearing Aids 159 N Dearborn St Chicago Ill.

Paravox Models VH and VL, Paravox Model XT, Paravox Model XTS, Paravox Model Y (YM, YC and YC-7)
Manufacturer Paraphone Hearing Aid Inc. 2056 E. 4th St. Cleveland Ohio

Radioear 45-CM, Radioear Model 45-M-magnetic air conduction receiver, Radioear Model 45-M-magnetic bone conduction receiver, Radioear Permo-Magnetic Uniphone, Radioear Permo-Magnetic Multipower
Manufacturer E A. Myers & Sons 306 Beverly Rd Mt. Lebanon Pittsburgh Pa.

Ravox (Semi-Portable)
Manufacturer Zenith Radio Corp 6001 W Dickens Ave, Chicago Ill.

Silver Micronic Hearing Aid Model 101, Silver Micronic Hearing Aid Models 202M and 202C
Manufacturer Micronic Corp 101 Tremont St. Boston 8 Mass

Sonotone Audicles No 530, No 531 and No 533, Sonotone Model 600, Sonotone Model 700, Sonotone Model 900
Manufacturer Sonotone Corp Elmsford N Y

Superfonic Hearing Aid
Manufacturer American Sound Products Inc 2454 S Michigan Ave Chicago Ill

Televox Model E

Manufacturer Televox Mfg Co, 117 S Broad St., Philadelphia 7 Pa

Telex Model 22, Telex Model 97, Telex Model 99, Telex Model 612, Telex Model 900, Telex Model 1020, Telex Model 1550, Telex Model 1700

Manufacturer Telex Inc, Minneapolis 1, Minn

Tonemaster Model Royal

Manufacturer Tonemasters Inc, 1627 Pacific Ave Dallas 1, Tex

Trimm Vacuum Tube No 300

Manufacturer Trimm, Inc, 400 W Lake St, Libertyville Ill

Unex Model "A", Unex Midget Model 95, Unex Midget Model 110

Manufacturer Nichols & Clark, Hathorne Mass

Vacolite Model J

Manufacturer Vacolite Co 3003 N Henderson St., Dallas 6, Tex

Western Electric Orthotronic Model, Western Electric Model 63, Western Electric Model 64, Western Electric Models 65 and 66

Manufacturer Western Electric Co Inc 120 Broadway New York 5 N Y

Zenith Radionic Model A-2-A, Zenith Radionic Model A 3 A Zenith Radionic Model B-3-A, Zenith Model 75, Zenith Miniature 75

Manufacturer Zenith Radio Corp, 6001 Dickens Ave, Chicago Ill

All of the accepted hearing devices employ vacuum tubes

• TABLE HEARING AIDS

Precision Table Hearing Aid *Jour A M A*, 139 785-786, March 19, 1949

Manufacturer Precision Electronics Co, 850 West Oakdale Ave Chicago 14, Ill

Sonotone Professional Table Set Model 50 Report not yet published

Manufacturer Sonotone Corp, Elmsford N Y

All of the Accepted hearing devices employ vacuum tubes

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E. Meltzer 20 Charlesgate West Boston 15 Mass
Secretary Dr Gordon D Hoople Medical Arts Bldg Syracuse 3 N Y
Meeting Mark Hopkins Hotel San Francisco Calif May 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A. Fenton 906 Medical Arts Bldg Portland Ore
Secretary Louis H Clerf 1530 Locust St Philadelphia 2 Pa
Meeting Mark Hopkins Hotel San Francisco Calif May 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin 384 Post St. San Francisco 8 Calif.
Secretary Dr C Stewart Nash, 708 Medical Arts Building Rochester N Y
Meeting Mark Hopkins Hotel, San Francisco Calif. May 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

Eastern Section Hotel Statler New York N Y Jan 5 1950
Council Meeting Hotel Statler New York City Jan 6 1950
Combined Meeting Southern and Middle Sections Peabody Hotel Memphis Tenn Jan. 16-17 1950
Western Section Medical Society Bulding Los Angeles Calif Jan. 21 22 1950

AMERICAN MEDICAL ASSOCIATION
SECTION ON LARYNGOLOGY OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward 104 E. Market St Charlottesville Va.
Secretary Dr James M Robb 641 David Whitney Bldg Detroit Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr J Mackenzie Brown 1136 W 6th St. Los Angeles Calif
President Elect
Executive Secretary Dr William L. Benedict Mayo Clinic Rochester Minn
Meeting Palmer House Chicago Ill Oct. 9 14 1949

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr Rea E Ashley, 384 Post St., San Francisco, Calif

Secretary-Treasurer Dr Joseph Hampsey, 806 May Bldg, Pittsburgh 22 Pa.

PAN AMERICAN ASSOCIATION OF OTO RHINO-LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L Jackson, 255 S 17th St., Philadelphia, Pa

Second Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology Montevideo, January, 1950

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President Dr LeRoy A Schall, 243 Charles St., Boston, Mass

Secretary Dr Edwin N Broyles, 1100 N Charles St Baltimore 1 Md.

Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Warren A. Wilson

Secretary Treasurer Dr Victor Goodhill.

Chairman of Section on Ophthalmology Dr George Landegger

Secretary of Section on Ophthalmology Dr Harold B Alexander

Chairman of Section on Otolaryngology Dr Alden H Miller

Secretary of Section on Otolaryngology Dr Leland R. House

Place Los Angeles County Medical Association Bldg, 1925 Wilshire Blvd, Los Angeles, Calif

Time 6 P.M, fourth Monday of each month from September to May, inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner, 115 E 61st Street, New York 21, N Y

Secretary Dr Norman N Smith, 291 Whitney Avenue, New Haven 11 Conn

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Garnett P Morison, Charles Town, W V

First Vice-President Dr Charles T St. Clair, Jr, Bluefield, W Va.

Second Vice-President Dr Arthur C Chandler, Charleston, W Va

Secretary Dr Melvin W McGehee, 425 Eleventh St, Huntington 1, W Va

Treasurer Dr Frederick C Reel, Charleston, W Va

Directors Dr Eugene C Hartman, Parkersburg, W Va., Dr Ivan Fawcett Wheeling, W Va

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Kate Savage Zerfoss, 165 Eighth Ave North Nashville 3 Tenn.
Chairman Elect Dr Calhoun McDougall, 703 Medical Arts Bldg Atlanta 3 Ga
Vice-Chairman Dr V R. Hurst, 315 N Center St., Longview Tex
Secretary Dr Alston Callahan, 908 S Twentieth St. Birmingham 5 Ala

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St. Philadelphia Pa
Vice-President Dr Thomas F Furlong, Jr 36 Parking Plaza, Ardmore Pa.
Treasurer Dr Harry P Schenck, 1912 Spruce St. Philadelphia Pa
Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa.

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Reinaldo de Villiers
Vicepresidente Dr César Cabrera Calderin
Secretario Dr José Xirau
Tesorero Dr Alfredo M Petit.
Vocal Dr José Gross
Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER — CAMPINAS

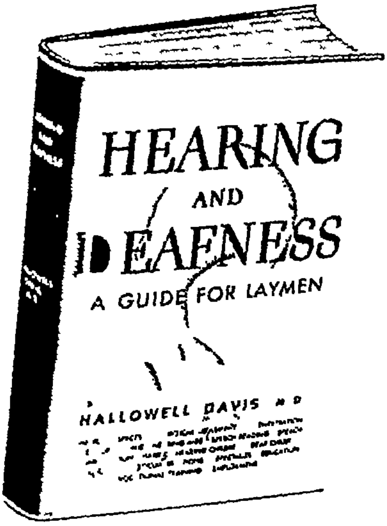
President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice-Presidente Dr Luis E Olsen
Secretario Dr Eugenio Romero Diaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez Dr Nondier Asis R Dr Jorge Bergallo Yotre

BUENOS AIRES CLUB OTORINOLARINGOLOGICO

Presidente Dr Juan Manuel Tato
Vice-Presidente Dr Norberto Von Soubiron.
Secretario Dr Oreste E Bergaglio
Pro-Secretario Dr Carlos A Gutierrez
Tesorero Dr Vicente R Carri
Pro-Tesorero Dr Jorge Couzo



The answers to problems of DEAFNESS

for the hard of hearing
and those who
work with them

JUST PUBLISHED

HEARING AND DEAFNESS

Edited by HALLOWELL DAVIS, M D

Director of Research Central Institute for the Deaf Research Professor of Otolaryngology Washington University School of Medicine

A MURRAY HILL BOOK
496 pages, 6 x 8½, 142 helpful illustrations, $5 00

Expert guidance from 14 specialists

1 AUDIOLOGY A MEETING OF VARIED SPECIALISTS
2 PHYSICS AND PSYCHOLOGY OF HEARING
3 ANATOMY AND PHYSIOLOGY OF THE EAR
4 MEDICAL ASPECTS OF HEARING LOSS
5 SURGICAL TREATMENT OF HEARING LOSS
6 TESTS OF HEARING
7 HEARING AIDS
8 THE CHOICE AND USE OF HEARING AIDS
9 SPEECH READING
10 AUDITORY TRAINING
11 CONSERVATION OF SPEECH
12 MILITARY AURAL REHABILITATION
13 FROM ARISTOTLE TO BELL
14 HARD-OF HEARING CHILDREN
15 DEAF CHILDREN
16 THE PSYCHOLOGY OF THE HARD-OF HEARING AND THE DEAFENED ADULT
17 ORGANIZATIONS FOR THE AURALLY HANDICAPPED
18 EMPLOYMENT FOR THE HARD OF HEARING
19 VOCATIONAL GUIDANCE FOR THE DEAF

HERE, in a single, easily-understood volume, is intensely practical guidance in dealing with the many physical social and economic handicaps of deafness. Edited by Dr Hallowell Davis HEARING AND DEAFNESS was written in collaboration by 14 experts Each brings the latest advice and information on that particular phase of the subject with which years of specialization have best equipped him or her to deal Their aim is to help hard of-hearing people in the most practical way possible by making them fully informed, by guiding them in seeking relief through modern scientific developments by helping them avoid useless expenditures and disappointments and, finally, if relief is not forthcoming to retain speech powers, to hold jobs and otherwise live as normally as possible.

Primarily written for the sufferers themselves the book is of equal value to physicians, educators sociologists and families of hard-of-hearing victims—to all who must, in one way or another, play a part in alleviating this distressing condition

should be in the hands of all the thousands of those who ask the questions and want to get the correct answers'

—C STEWART NASH President American Hearing Society

" Here, at last, is information correct, easy to read covering nearly every phase of the problem in a manner suited to laymen HEARING AND DEAFNESS should be the means of greatly lessening the handicap of deafness

—LOUISE TRACY The John Tracy Clinic

Order from

The Laryngoscope

640 So. Kingshighway St. Louis 10, Mo.

THE

LARYNGOSCOPE.

VOL. LIX DECEMBER, 1949 NO. 12

PSYCHOSOMATIC APHONIA AND EPHEMERAL ADDUCTOR PARALYSIS

CHEVALIER JACKSON, M. D.,
Philadelphia, Pa.

Psychosomatic laryngeal manifestations usually affect the most conspicuous function, namely, phonation. Of the other eight functions, the tussive is practically the only one thus affected. As shown by Jackson and Jackson,[1] the old adjectives, hysterical, voluntary, functional, formerly misapplied to this condition are semantic solecisms and should be dropped from the literature.

Etiology and Pathology. As stated by the just mentioned authors, most of the cases are essentially traumatic neuroses. They found that many cases originated in *ephemeral adductor paralysis*.[1] This transitory paralysis, they point out, is due to sudden circulatory disturbance, usually anemic, of the anterior cerebral cortex. In common parlance this condition is often referred to as "knocked speechless," "speech bound," "speech bereft," "dumbfounded," "struck dumb." Though these expressions are common in lay literature, their significance does not seem to have been recognized by medical authors other than those cited.[1] The sudden anemia of the cerebral cortex in the minor form of syncope called fainting or swooning is

---

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Aug. 1, 1949.

commonly associated with an ephemeral adductor paralysis. This phase, in swooning, passes so quickly into unconsciousness that the adductor paralysis is not ordinarily noticed, but the authors mentioned have observed it in the laryngeal mirror in cases of fainting from various causes.[1] When the degree of cerebral anemia is not quite sufficient to cause loss of consciousness, the person affected by a terrific sight or a shocking experience notices his loss of power to speak, hence his expression, "I was struck dumb," or "I was dumbfounded," or "I was knocked speechless." In many instances of fainting or swooning, the person affected, after recovering consciousness, will recall the loss of power to speak.[1]

Pathologically, the laryngeal condition of failure in adduction in ephemeral adductor paralysis is, in a sense, somal rather than functional, inasmuch as the cells of the anterior motor cortex are deprived of their blood supply. When, however, the psychic impression of inability to speak becomes fixed, as is sometimes the case, a phychosomatic aphonia is established. This is only one of the ways in which this type of aphonia originates. Various forms of suggestion may become fixed. In some cases anxiety over prospect of loss of voice, suggested by acute laryngitis or other incident, may be an etiologic factor. These patients are usually occupational voice users. In most instances psychosomatic aphonia is a traumatic neurosis. Physical trauma may or may not have been concurrent, but its effect is through its additional mental impact. In some cases the suggestive physical trauma may have been in the region of the larynx.[1]

Psychosomatic aphonia may develop immediately after the psychic trauma or later. The onset is usually sudden, but in some cases it is gradual. When predisposing factors result from overwork, grief, anxiety, worry and other long continued strains, the memory of any incident referable to the voice, or even the larynx, may result graually in a psychosomatic aphonia, though often even in these cases the onset is sudden. In some cases the etiologic suggestion may come from loss of voice affecting a relative or even from a vivid account of such a loss.

Though in some cases predisposing factors cannot be traced, yet in most cases such factors are found As with other psychosomatic conditions, hereditary factors may contribute to vulnerability under strain There is a wide variation in powers of resistance We are not all born with the same amount of resistance to the ill effects of the anxieties and worries of life Many are born of parents whose hereditary backgrounds contain cases of psychopathic or psychotic disorders Excesses, especially alcoholic, on the part of parents tranmit deficiencies in powers of resistance to the ill effects of strain This factor is progressively on the increase

Symptoms The chief complaint of the patient is that he has lost his voice By this he may mean that he has lost only his phonatory voice or both phonatory and whispered voice In the latter case, which is less common, the patient may write everything he has to say or he may make efforts to communicate by signs He may just listen attentively to the description of his disability by an accompanying relative, friend or physician When asked a question he may simply shake his head or he may make prodigious movements of his facial muscles without uttering a laryngeal sound If he has not lost his ability to whisper he may whisper freely or be brief and reticent He may seem distressed about his disability or proud of it, as if it were interesting in its rariety and mystification [1]

Laryngeal Appearances To the laryngologist who is accustomed to seeing the approximation of the vocal cords when the patient attempts to say E-e-e-e with the mirror in place, three significant abnormalities in a typical case of psychosomatic aphonia are striking *a* The vocal cords remain in the quiet breathing position, *b* the arytenoid eminences are motionless, *c* the larynx fails to rise With this clear picture of the typical case in mind, the slight variations in laryngeal appearance will be easily detected In some cases at times the cords will be seen to go part way toward the midline, then fall back outward again to the quiet breathing position If asked to say E-e-e-e again, the partial excursion may or may not be repeated When the patient is asked to cough, the vocal cords are seen to approximate for a moment, then permitting the expulsion of a puff of air carrying with it the sound waves characteristic of cough The sound of the cough is the normal one of glottic closure As a matter of differential diagnosis it is important to remember that if the patient should cough without glottic closure the case is not one of psychosomatic aphonia It will be noticed that the cough without glottic closure has a harsh rasping sound of air waste

Diagnosis The mirror appearances are diagnostic unless the patient refuses to cough In this case direct laryngoscopy should be done without anesthesia At the approach of the direct laryngoscope the glottis will be snapped shut by the adductor muscles One important diagnostic sign, unmentioned in the literature, is the sound of glottic cooperation in cough The sounds of presence and of absence, respectively, are unmistakable to the practiced ear (Case 5) Every human being has to cough occasionally whether he wants to do so or not, and it can be provoked my various means This sign of approximative power, of course, has its greatest usefulness in cure of uncooperative patients With approximative power present, willful silence remains to be excluded This diagnostic possibility may be in one of two forms, psychotic and purposeful As a feature of a psychosis it occurs as the willful stubborn silence called aphonia paranoica The features of a psychosis are so conspicuous that diagnosis presents little difficulty The diagnosis of the silence of malingering is not always so easy The malingerer knows he can talk, but refuses to do so for a definite purpose, such as to escape duty or to perpetrate a fraud Claims for disability may be on the basis of a loss of voice alone or in combination with simulation of other forms of disability, or, oftener, in combination with well substantiated physical injuries Compensation claims are usually for relatively small amounts, but claims for damages may be large in case of occupational voice users and enormous in case of professional vocalists This matter of purpose is important diagnostically, and should be searched for if not evident In a number of cases the patient was brought in for consultation by the family physician from whom the ulterior motive of a damage suit had been concealed There is one important sign of malingering to be noted by careful attention to the manner of the patient He is suspicious of a trap that will reveal his fraudulent purpose If carefully watched for, there will be noted a manner of hesitation and suspicion preceding his compliance with requests He does not freely and frankly cooperate in examinations and tests He may not consent, if he does, it is likely to be partially or delayed When these signs are noted psychosis must be eliminated, as suspicion is often present in psychopaths and in psychotics Having eliminated the possibilities, the probability of malingering is put to the final test, which is therapeutic Phonation can be restored by treatment if there is no psychotic trouble and no malingering If the methods of the laryngologist fail to restore the voice, the patient should be turned over to the psychiatrist for treatment The malingerer will usually balk at this

Treatment The first question to be decided is as to when treatment should begin Broadly speaking, there are two classes of cases to be considered In the first class are the cases in which the chief and determining cause has been a violent and shocking episode occurring when the patient was in relatively good health In the second class are the cases in which the aphonia has been largely due to prolonged strain and nervous exhaustion In the first class of case the treatment should be begun as soon as the novelty of the situation has worn off and the patient has or can quickly develop a desire to get the voice back In the second class of case a period of rest under general medical care and management is essential It is a serious mistake to begin treatment while the patient is fatigued, exhausted and depressed There are a number of reasons *1* These conditions are causes, hence should not be allowed to continue *2* The patient, worn out and in need of rest, really cares little whether he gets well or not, hence it is difficult or impossible to create the essential confidence and cooperation *3* Failure is almost certain *4* Failure enormously increases the difficulty of subsequent cure, because *a* it discourages the patient, *b* it renders him skeptical as to cure *c* he is almost certain to recognize similarity of technique of treatment in which he has lost faith, *d* it is always best, if possible, to carry through the psychic treatment to successful phonation at the first seance

The basic condition in psychosomatic aphonia being essentially psychic, the treatment of it is essentially psychic This form of treatment for success requires certain personal qualifications that many physicians do not possess The neurologist and the psychiatrist, of necessity, have these qualifications well developed The personal qualifications required in psychosomatic aphonia cannot be accurately described The manner must be firm, self-confident, never discouraged or taken back, never admitting failure Though dominating, his manner must be kindly, never irritated or annoyed Certain errors must be avoided The patient must not be told that he could talk if he wanted to He must not be allowed to think his ailment is mysterious, puzzling or problematical

For success it is well for the physician to get the conception that the abnormality in psychosomatic aphonia is that the patient *believes* he has lost his voice It is not imaginative in the ordinary sense of that term It is not willful nor intentional It is a belief rather than an illusion, delusion or hallucination

The first step is to inspire confidence in the patient He should be given a simple statement such as that his trouble is a well known form of imperfect coordination of vocal muscles, and is curable by a system of exercises

The next step is to get the patient to make a sound in some way other than an effort to say a word The method mentioned in the case reports is usually successful and illustrates what is meant by a method other than saying a word To try to say a word meets and rarely surmounts the patient's basic difficulty Producing a sound in some other way can be made to impress the patient that he is getting a start on learning to talk by a method that is free from his difficulties When the patient produces a phonatory grunt by bringing his elbows down with a thump against his sides he can be easily convinced that he has started learning a new way of talking

Further steps of a successful plan of treatment will be given in connection with reports of cases in which it was used The report of a typical case of each of the most frequently encountered varieties of psychosomatic aphonia will serve to illustrate the most important clinical features better than a space consuming large series of case reports which would be confusing and perhaps unread

Case 1 A woman aged 22, supported her ill and widowed mother by working as a telephone operator in a hospital Long hours of duty were followed by long hours in care of her mother and their two rooms While she was busy at her switchboard a psychotic patient came in and garroted her to unconsciousness before he could be forced by rescuers to release the grip of his hands on her throat She was quickly resuscitated Examination in the surgical department was negative except for a slight swelling of the soft tissues of the neck and a few ecchymotic spots on the skin There was no dyspnea and Roentgen examination showed no evidence of fracture of the hyoid bone or thyroid cartilage On the tenth day after the garroting the patient was still in the hospital and laryngeal examination was requested because of loss of voice The patient was found crying and when asked why she wrote I have lost my voice and will lose my position as a telephone operator What will my poor mother do? The night nurse reported the patient was restless cried frequently through the night and moaned though she did not say a word Palpation of the neck and careful palpation of the laryngeal cartilages revealed no tenderness or other laryngeal abnormality Mirror examination showed the glottis in the position of quiet breathing When the patient was asked to take a deep breath the cords increased their separation normally When the patient was asked to say Ee-e-e she shook her head slightly and no movement of the glottic margins was perceptible in the mirror When asked to say Ah they were motionless When asked to cough the patient made an effort to do so the cords promptly and normally approximated for a moment and the characteristic sound of cough with glottic cooperation was plainly audible Obviously the aphonia was psychosomatic The patient was told that shock had caused a little imperfect muscular action in the larynx that she would get well under treatment and that she would have a good voice for continuing her work as a telephone operator She was assured that this would be done by a method that amounted to learning to talk in a new way Her confidence and hearty cooperation were obtained The start in phonation was made by the patient bringing her bent elbows forcibly to her sides in a thump coincident with a grunt. Her attention was then called to the fact that the sound of the grunt was the start and that the next step would be the vowel sounds The first was O She watched the physician s mouth as he emitted a clear strong Oh sound She promptly sounded the vowel Then the other vowels followed in succession She was then enthusiastic and talking freely and did not need to be trained on consonants In two weeks she was back on duty at the switchboard and there was no recurrence

Comment The fright and subjective sense of imminent death by suffocation produced a profound shock When she became conscious her vivid recollection of those hands painfully gripping her neck fixed her attention on her larynx Her first attempts to speak were naturally feeble and imperfect, she assumed permanent injury had been done to her larynx Her anxiety about her mother, the prospect of losing her voice and the means of support for herself and her invalid and widowed mother, all were typical causes of psychosomatic aphonia Her long hours of overwork at the switchboard and at home were predisposing factors Few cases are so complete Only an hereditary background suggesting vulnerability was lacking Direct violence in the region of the larynx is uncommon, though we have seen a few cases, of which the following is another example

Case 2 A front brakeman on a freight train, aged 28, was referred for an opinion because of a claim for permanent disability based on total loss of voice The history was that the loss of voice followed an injury by a blow on the side of the neck while on duty in the cab of a locomotive The fireman was pulling clinkers when a sudden coming away of a clinker allowed the proximal end of the clinker hook in the fireman s clenched fist to strike the claimant on the side of the neck The force of the blow knocked him over onto the loose coal in the tender, which caused him to lose his footing and fall In falling he slid almost off the train between the cab and the tank his head shoulders and arms dangling out. When dragged back to safety, he tried to curse the fireman for carelessness but found himself speechless The company surgeon found no evidence of cervical trauma, but the inability to phonate had persisted for two months when an attorney strongely urged putting in a disability claim A consultant for the defense thought malingering was indicated by the fact that the whisper was also gone The patient was brought for an opinion on the diagnostic problem Mirror examination showed the normal image of quiet breathing with symmetric separation of the cords as the base of the glottic triangle lengthened in response to a request that a deep breath be taken When asked to say "E-e-e-e' the patient shook his head, and no movement of the cords or arytenoids was perceptible in the mirror When the patient was asked to cough, the cords were seen to approximate for a moment and the typical sound of cough with glottic cooperation was audible Obviously a diagnosis of psychosomatic aphonia required only elimination of malingering for the purpose of supporting a disability claim as alleged by the defense The claimant gave the impression of sincerity The family physician stated the claimant had been reluctant to sign claim papers During the laryngeal examination claimant had cooperated promptly and willingly in every way, with no hesitation that would imply suspicion of a trap He was perfectly willing to have Roentgen examination and laboratory tests made These evidences of sincerity called for a therapeutic test thorough and repeated a number of times if negative The hearty cooperation of the patient in the same plan of treatment as in the preceding case resulted in restoration of the voice and in the dropping of the claim for disability

Comment The etiologic factor of direct trauma inflicted in the laryngeal region, though undoubtedly important in both this and the preceding case, is relatively rare The trauma is usually only psychic, as in the following case

Case 3 A woman, aged 23, saw an automobile backing out of the garage toward her two year-old child who was standing in the neighbor s driveway She ran and waved her arms, then fell in syncope as she saw the child's head crushed under the rear wheel When resuscitated she tried to speak but evidently could not utter a word The next day she was able to whisper, but she could not phonate She stated that she had tried to scream to warn the driver, but she could not utter a word The horror at the sight of her child s head being crushed and the speechless condition that rendered her powerless to scream a warning to the driver were the last two things she remembered Mirror examination of the larynx showed no phonative approximation when the patient was asked to say E-e-e-e," but good phonative approximation on coughing Obviously the case was one of psychosomatic aphonia In consultation with the family physician it was decided best to postpone treatment of the aphonia until proper care had been given to the patient s grief stricken state and profound shock. About a month later there was great improvement in the general condition of the patient but the voice had not returned and mirror examination showed no change Treatment of the plan mentioned above was successful in restoration of the voice at the first seance

Comment In this case there was no hereditary factor found in the history The patient was not neurotic, there had apparently been no particular strain prior to the horrible spectacle There was no direct physical trauma All the features of the case justified the opinion that the chief cause was the psychic trauma that produced the ephemeral adductor paralysis The fixation on the phonatory function was due to the powerful mental impression of loss of voice at the moment she needed it in her effort to prevent her child from being crushed to death

Case 4 A veteran of World War II, aged 29 brought with him a lengthy self written statement of his case from which the significant points are here abstracted After nearly three months of active service at or near the front, he was evacuated to a base hospital as a case of battle fatigue His chief complaint at that time was loss of voice He was unable even to whisper He could whistle to call attention and he made signs when necessary to call attention to his needs He said he lost his voice suddenly just as he had almost recovered from hoarseness accompanying an attack of the then prevalent acute laryngitis The whisper he used during the attack of laryngitis to save his larynx was lost at the same time At the base hospital under a regimen of rest his voice did not return but his general condition improved to a point at which his request to be returned to active duty was granted He was assigned to light duty on a hospital ship Two months later his term of enlistment having expired his request for release from service was granted by honorable discharge His father a physician brought him in for consultation concerning his loss of voice his only remaining disability Mirror examination revealed no laryngeal abnormality except that there was no perceptible approximation of the vocal cords nor any movement of the arytenoids, when the patient was requested to say "E-e e-e" He seemed to make a sincere effort to phonate, but the only response to the effort was a movement of some of the facial and cervical muscles When asked to cough, these muscles did not seem to move, but prompt though momentary approximation was noted in the mirror In beginning treatment, enthusiastic cooperation of the patient was obtained when he became convinced that his phonatory cough and the thumping grunt constituted a good beginning on a series of exercises that would enable him to learn to talk in a new way He responded well to the vowel exercises A plainly audible "O" was followed by a louder 'A" and by each of the vowels in succession The first consonant was mastered when, by giving the patient a tooth brush bristle and telling him to place it on the tip of his tongue, hold it against his front teeth, then force it out with a blast of air in the usual way He was familiar with the technique from personal experience, but he was given an example to imitate After he had performed the exercise three times he was instructed to add the "O" vowel sound to the dental consonant of the bristle exercise He was greatly surprised and delighted when he uttered a loud and clear "Toe" The patient and his father carried on the exercises, and the father reported a month later that there was perfect restoration of voice Three years later the patient was reported free from recurrence

Comment Undoubtedly the basic factor in this case of psychosomatic aphonia was the long continued strain, the exhausting daily physical fatigue, along with the impact of almost continuous day and night roar of artillery fire and bomb explosions that rendered any real rest period impossible Of course, this is well understood in the services, and intervals of rest of personnel are routine, but under active conditions at the front, such intervals for every individual are not always possible, and so it had been in his case The point germane to our subject is that the prompt response to psychic treatment was due to the long rest in the base hospital and on light duty in the quiet of the hospital ship A rather large experience with veterans, civilians employed by the services as well as with civilians in private life justifies the conclusion that had the psychic treatment been attempted in the earlier stages of the disorder, failure would have resulted, and, worse yet, the failure would have rendered subsequent cure exceedingly difficult The patient would have been discouraged, skeptical of help, and would have been likely to detect the technique of treatment and to lack faith in any subsequent effort to help him

Case 5 A 13 year old neurotic and atypical boy, whose father died of alcoholism, was recovering from a prolonged manifestation of barking cough of puberty, when he was reproved by his mother for continuous misconduct reported by his school teacher The next morning he whispered in his mother's ear that his voice was gone and there was no use going to school because he could not recite Then he became sullenly silent refusing to answer questions He was brought in by the family physician for an opinion as to whether or not there was any laryngeal abnormality concerned in the loss of phonation The boy was present under protest and promptly in a hissing whisper expressed his determination not to allow any kind of examination Then he was sullen and silent however his attitude was moderated by engaging him in an expression of his views of events in baseball When the conversation lagged he was casually asked if his recent coughing attacks had interfered with his own expert batting Immediately he emitted a loud barking cough that was unquestionably phonatory and had the characteristic sound of glottic cooperation In the subsequent report to the family physician it was stated that though this audible evidence of cordal approximation was incontrovertible yet inferential diagnoses of laryngeal conditions in children should always be subject to direct laryngeal examination It so happened in this case that removal of badly diseased tonsils had been previously planned and it was arranged for the rhinolaryngologist to make a direct laryngoscopic examination incidental to the aspiration of blood after the tonsils were out. The rhinolaryngologist found the larynx normal in every way and reported further that as the child was coming out of the anesthesia there was an active glottic closure reflex at the approach of the laryngoscope The tonsillectomy had no effect on the aphonia In consultation with the family physician it was decided to advise placing the child under the care of a psychiatrist. Ultimately this patient suddenly developed dementia precox.

Comment This case is one of a type for which the laryngologist should always be on the alert The aphonia, though superficially similar to the psychosomatic types, was really a distance signal of the approaching schizophrenia The vocal phase was a typical aphonia paranoica and not strictly speaking a psychosomatic aphonia It is advisable for the laryngologist in cases of aphonia to be always alert to psychotic possibilities Even in mild psychopathic patients there are problems that can be properly dealt with only by a psychiatrist The psychosomatic aphonia in many psychopaths is only a small part of the problem The laryngologist's results are usually disappointing in such cases, whereas, under the care of a psychiatrist, except in cases of incurable dementia or of the willful aphonias such as aphonia paranoica, the results are usually good

SUMMARY

The most common cause of psychosomatic aphonia is psychic trauma It often originates in an *ephemeral adductor paralysis* due to sudden anemia of the anterior cerebral cortex as in syncope, commonly called fainting or swooning In common parlance this is often referred to as "knocked speechless," "dumbfounded," "struck dumb" Though these expressions are common in lay literature, their significance does not seem to have been recognized by medical authors other than those cited Etiology, pathology, laryngoscopic appearances, symptoms, diagnosis and treatment are considered and illustrative cases are cited

REFERENCE

1 JACKSON, CHEVALIER, and JACKSON, CHEVALIER L Diseases of the Nose, Throat and Ear Philadelphia W B Saunders Co, 1945

3401 North Broad Street

II PANAMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY

The second PanAmerican Congress of Otorhinolaryngology and Bronchoesophagology will be held in Montevideo-Buenos Aires, Jan 8 to 15, 1950 For further information communicate with Dr Chevalier L Jackson, 3401 North Broad Street, Philadelphia 40, Pa

THE FENESTRATION OPERATION FOR OTOSCLEROSIS

A Survey of Experience with 75 Cases Together with a Study of the Effect of the Contralateral Ear*†

De Graaf Woodman, M.D.,
New York, N. Y.

To Barany,[1] in the year 1910, goes the credit for being the first to advocate and perform an opening in one of the semicircular canals for the relief of otosclerosis. Prior to his work, others had tried such procedures as the removal of the stapes by Kessel[2], in 1876, and later, in 1897, Passow[3] made a fistula in the promontory.

It was Jenkins,[4] in 1914, who first made a fistula in the horizontal canal and covered it with a Thiersch graft and then with a flap from the external meatus. Holmgren[5] followed, in 1917, with many years of experimentation. He tried the placing of various substances in the fistulae in an effort to prevent their closure.

Sourdille,[6] in his report of 1935, reported a series of 109 cases with many patients showing good results. His successes resulted from the use of a viable flap made in a three-stage operation which was called the tympanolabyrinthopexie.

The real impetus was given to the surgical approach for the relief of otosclerosis by Lempert in his report of 1938. In this report he described a one-stage operation in which he

---

*From the Department of Otolaryngology, Presbyterian Hospital and College of Physicians and Surgeons, Columbia University.

†Presented as Candidate's Thesis to the American Laryngological, Rhinological and Otological Society, Inc.

Editor's Note: This ms. received in Laryngoscope Office [illegible] and accepted for publication July 1, [illegible]

used a skin flap like Sourdille's[6] to cover the fistula made from the lining membrane of the external auditory canal He was able to show a large percentage of cases with lasting improvement proven by audiograms before and after operation This technique was placed on an even firmer basis when, in 1941, Lempert[8] published a further modification in which he placed the fistula at the ampulated end of the horizontal canal This he termed the fenestra novovalis This modification resulted in an even greater number of cases which showed lasting improvement and less tendency to develop bony closure

This survey of experiences herein reported covers 75 fenestration operations done during the past three and one-half years The experiences cover complications, accidents, the effect of infection on postoperative results, and an autopsy report with histological findings

The criteria used for selecting cases for operation was that of a progressive bilateral conductive type of hearing loss in which the air conduction for the critical speech frequencies was below the 30 db level and in which the cochlear function, as indicated by bone conduction, remained above the 30 db level and preferably not below the 20 db level

Few exceptions were made to this criteria for case selection There were three cases of unilateral conductive deafness with a family history of otosclerosis There was one case in which the bone conduction for the 2048 frequency was down to 35 db

The poorer of the two ears was generally chosen unless one ear had a great deal more tinnitus than the other, in which event the one with the greater amount of tinnitus was selected

All cases had intact eardrums patent Eustachian tubes and no evidence of recent ear infection

ANESTHESIA

All of these cases were done under general anesthesia with intravenous sodium pentothal together with nitrous oxide and oxygen via an intratracheal airway

METHOD

The method used in this series followed the general pattern described by Lempert,[8] namely, the endaural approach with the fenestra made in what he calls the "surgical dome" of the vestibule or ampulated end of the bony horizintal semicircular canal The fistula is covered by a flap made from the lining membrane of the posterior superior part of the external canal wall continuous with Schrapnell's membrane

Some modifications have gradually superseded the originally described technique The triangle incision with removal of skin flap was given up in favor of a single incision, thus removing no skin and leaving a larger flap for filling in the cavity This is somewhat similar to the technique described by Whitaker, Juers and Shambaugh[9] Occasionally this flap was made to retract better by two or three short right angle incisions to the edge of the original incision which permitted the flap to fold back more readily into the cavity The mastoid cavity was only exenterated sufficiently to permit good exposure and working room for the drill to have free action in making the fenestra

The horizontal canal was always well skeletonized and the facial ridge demonstrated and its mucosal covering elevated forward Efforts were made to obtain a surface smoothed down well around the canal in order to prevent a deep trough-like exposure of the membranous canal

The fenestra was made with No 3 size and No 2 size dental polishing burrs and for the past two years efforts were made to emphasize the blue line either side of the membranous canal, rather than directly over its midline axis This, I believe, is similar to the technique described by House[10] and called by him "the double blue line technique"

This technique permits getting off that part of the endosteum directly over the labyrinth, in one large piece, and may thus help in minimizing damage to the endosteal membrane and the membranous labyrinth Certainly it permits getting most of the fragments and dust away before removing the endosteal membrane At this writing a recent article by Lempert[11] describes in detail a new technique for removing the endosteal bony layer in one piece, thus avoiding the risk of bony fragments being lost in the perilymphatic space

For the past 18 months the continuous flow suction apparatus devised by Shambaugh[12] has been used at the time of making the fenestra We have continued to use loupe magnification rather than the dissecting microscope with its restrictions of free motion

The flap has always been prepared and thinned out before starting the fenestra The flap is tucked forward into the external meatus and 1 cc of 1/1000 adrenalin is poured into the cavity just before starting the fenestra We have not felt it safe to cover the flap with any protective material such as vaseline gauze or rubber tissue due to lack of room and the fear of catching it in the burr

In this series two cases were done successfully by the postauricular approach In three cases a cartilaginous stopple was placed All three were failures One of these had a revision and, while no preoperative hearing level was lost, very little, if any, improvement was shown following the revision

The flap was held in place with a small butterfly made of mesh paraffin gauze placed just above but not directly over the fenestra A small pledget of cotton covered with sulfathiazol ointment covers the drum The remaining cavity is packed with wide mesh paraffinized gauze In some cases melted paraffin was used, but for the past two years this has been replaced with mesh gauze and foam sponge packing, the latter being easier to remove and it also offers less danger of overheating the tissues by the use of too hot paraffin

POSTOPERATIVE CARE.

Patients were placed on sulfadiazine therapy immediately after operation until two years ago, and since then intramuscular penicillin was used exclusively At the present time penicillin is given in doses of 250,000 units bd and is administered during the entire postoperative stay in the hospital which averages 12 days

Patients are given an infusion during or immediately after operation Most patients take their fluids the following morning after operation Rarely is it necessary to carry on infusions after the first 24 hours Patients are allowed up as soon as the acute dizziness has subsided, which is usually the third or fourth postoperative day

The outer bandage is generally changed on the second postoperative day The wound is first dressed on the fifth day Rarely is the dressing changed on the fourth day, and then only if the patient complains of discomfort, or any elevation of temperature or symptoms which suggest the possibility of a labyrinthitis At the time of the first dressing all of the packing is removed A small pledget of cotton is placed in the vestibule of the ear and a vaseline gauze pack is placed between the upper edges of the wound, which helps to prevent this part of the incision from growing together too rapidly This permits a better exposure and prevents the contracture of the vestibule of the canal, which may cause considerable difficulty in postoperative care

Our experience has not been as favorable as that reported by some operators on the rapidity of the complete healing and epithelization of the cavity We have had some ear cavities completely dry in six weeks but very few The average is much nearer 12 weeks One of our best results took over 18 months before all granulations were gone and complete epithelization occurred All cases have eventually dried up completely

Audiometric tests are seldom done before the third or fourth week or until the cavity is free of all dressings and active drainage Voice and tuning fork tests are resorted to during this period

Routine audiometrics are done 3, 6, 9, 12, 18, 24 and 36 months after operation Both ears are tested for both air and bone conduction Masking is done whenever indicated

COMPLICATIONS

Considering the fact that the fenestration operation is one which requires rather rigid adherence to the technical details of proven step by step procedure, it is surprising that the number of complications are not more frequent than we have experienced

There were three cases of transient facial paralysis All of these cases developed this paralysis two to five days after the operation and all cleared up completely within a month of the onset of this complication

There were two cases of perichondritis Both occurred three weeks following operation and both were readmitted to the hospital, where through and through incisions were made in the auricle and drains placed One case was proven to be secondary to a pyocyanus infection and this case was kept covered with dressing soaked with acetic acid, the other case was treated with streptomycin and it in turn improved rapidly under this therapy

Both these cases had some residual thickening of the auricle but no gross deformity, and the canal remained open and easy to treat One of the two cases continued on as a good result with complete rehabilitation (method of classifying results to be elaborated upon later in the paper) The other case did not improve but showed no deterioration as the result of this complication

There was one case of foreign body in the bony labyrinth A small piece, one-sixteenth inch, broke off the dental excavator and fell into the bony labyrinth, deep to and partially under the membranous labyrinth This was recovered by placing the small flap elevator just at the edge of the fistula and then attaching the portable electric magnet used by ophthalmologists The piece was recovered without damage to the membranous labyrinth, and this case continued on to become one of the rehabilitated cases

In two cases, perforations of the drum occurred at operation One of these cases sloughed off the flap in the region of the fistula and continued to show progressive loss of initial improvement, the other case did well and obtained a result above the threshold level One patient blew his nose hard postoperatively and perforated his drum and developed a middle ear infection about two months after the operation In this case the middle ear infection subsided, but a posterior inferior perforation remains The patient, however, continued to maintain a high level above threshold three years since the complication occurred

Two cases developed a sulfa therapy sensitivity in the course of treating their ear cavities with sulfadiazine powder These cleared up rapidly on withdrawal of the sulfadiazine, with no more than a body rash and mild temperature elevation for a few days One case became sensitive to penicillin This was noted two days after the packing was removed, that is, seven days after operation The cavity became filled with a purulent drainage and it looked as though the flap would probably slough out This case was placed on sulfadiazine therapy and the cavity healed up rapidly and continued on as one of the best of the completely rehabilitated cases

Tinnitus is alleviated in the majority of the cases following the making of the fenestra, but when and if it does recur it is frequently a sign of beginning closure of the fistula

Vertigo has never been persistent in any of the cases in this series Most cases have marked vertigo for two to three days and on the fourth to fifth day are up and walking about the ward One case complained of vertigo on sudden change of motion for three months This case continued on to the rehabilitation level

The effect of infection on postoperative healing is well demonstrated by the case of a man, age 43, with a family history of otosclerosis His audiogram indicated a mixed type of deafness with a rather marked loss of high tones The 2048 frequency threshold was down to 35 db for bone conduction

This patient showed no improvement at the first postoperative audiogram, done three weeks following the fenestration He noted very little subjective improvement until two and one-half months had elapsed, at which time a badly diseased tooth root was removed A few days following this, he noted marked improvement The audiogram done one week after tooth extraction showed a dramatic improvement in the threshold level, which improvement continued until the end of the first year, and this gain has held its level through his third-year test

Table 1 shows the average decibel level in the critical frequencies for both air and bone conduction throughout the course of his postoperative period This demonstrates the fact that in certain cases a toxic focus can impede an immediate improvement

TABLE 1

Average decibel level for critical frequencies	AC	BC
Preoperative, 8-1-45	65	8.3
Postoperative, 8-20-45	53.3	23.3
Post removal of diseased tooth root, 10-22-45	33.3	—16.6
One year postoperative 8-5-46	25	—10
Two years postoperative	21.6	— 3.3
Three years postoperative	20	5

One case came to autopsy 16 days post-fenestration This was a man, age 50, with a bilateral progressive deafness, who had had a past history of mild hypertension and kidney dys function He was checked by the internist and genitourinary specialist and pronounced fit for operation His first five days after the fenestration were uneventful He noted considerable subjective sense of hearing improvement On the fifth postoperative day he developed a spiking temperature and mental changes This was followed by cardiac and chest complications At autopsy he was shown to have massive thrombi in the pulmonary, cerebral and leg veins with myocardial infarction, cerebral degeneration and cystitis

This case made it possible to obtain the microphotographs of the temporal bone showing the fenestra and the flap They also show the close adherence of the skin flap to the membranous labyrinth The flap itself appears fairly thick Fowler[13] maintains the thickness of monkey flaps as being associated with postoperative edema In this case the thickness is probably in part due to the proximity to operation and also to the congestion associated with his venous thrombosis Fig 1 shows the flap over the ampullated end of the membranous horizontal canal Fig 2 shows the flap over the membranous ampulla itself

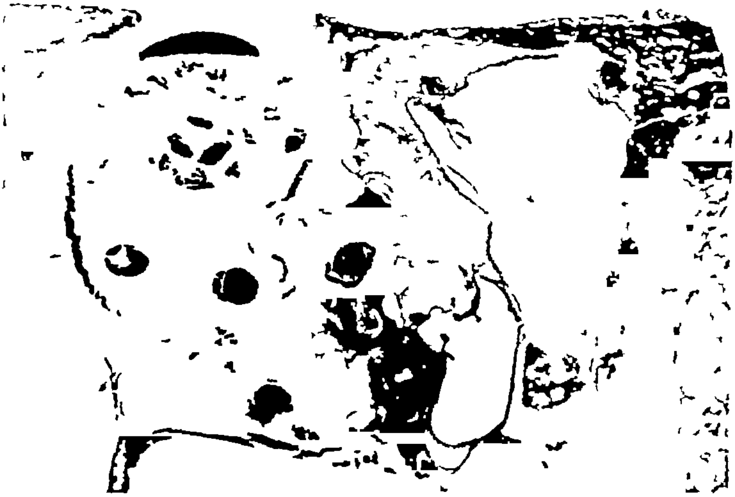


Fig 1 Microphotograph of temporal bone showing the flap covering the fistula over the ampullated end of the membranous horizontal canal

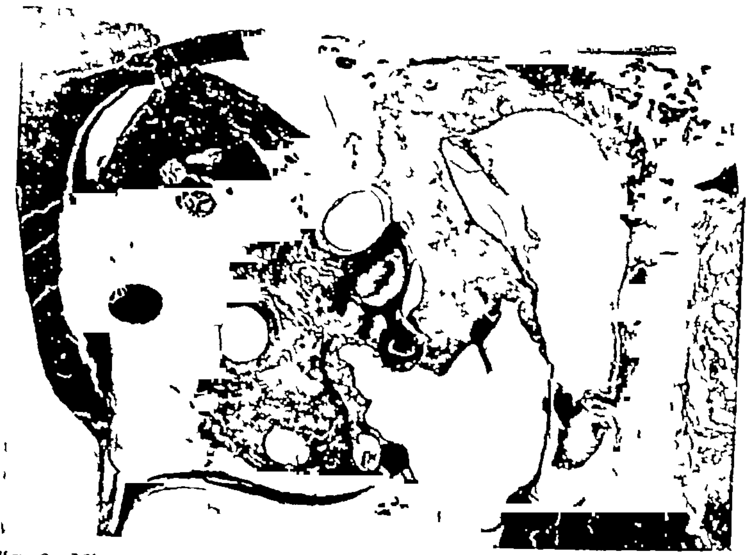


Fig 2 Microphotograph of temporal bone showing the fistula over membranous ampulla itself

HISTOLOGICAL REPORT

(Submitted by Dr Franz Altmann) The histological examination of the left temporal bone in vertical serial section showed a typically located otosclerotic focus on the anterosuperior circumference of the oval window The fistula extends from the anterior part of the ampullated end of the horizontal canal over the ampulla itself Its margins are smooth and there are no reactive changes in any of the three layers of the capsule

The flap is continuous with the drum and everywhere adherent to the surface of the bone except where it has been pulled away during the preparation of the specimen The flap fills the defect of the bony capsule completely without protruding to any noticeable degree into the lumen of the perilymphatic space The flap is covered with stratified squamous epithelium which from the margins of the flap grows over the adjacent areas of the operative cavity The flap consists of corium, subcutaneous connective and some fat tissue There is marked edema and vascular congestion of the tissues with small perivascular extravasations in some places In some areas perivascular round cell infiltration is noted Nowhere is there evidence of new formation of bone In one place a tiny splinter of old bone is seen on the undersurface of the part of the flap which covers the fistula

The meso and hypotympanum show moderately marked hyperplastic changes in the mucosa with formation of folds and strands of organized tissue, particularly in the window niches In addition there are moderate acute inflammatory changes and some blood and seropurulent exudate in the middle ear cavity

The *ampullar end of the horizontal membranous canal* is adherent to the undersurface of the flap The ampulla itself is separated from it

The membranous endosteum at the margins of the fistula appears intact and there are no bony splinters in the perilymphatic space The vestibule contains some blood There is evidence of a subsiding mild diffuse serous labyrinthitis

Sections through the cochlear show marked postmortem changes but no evidence of any pathology

METHOD OF REPORTING END-RESULTS

The reporting of end-results by various surgeons doing the fenestration operation has not been uniform This has resulted in considerable confusion in evaluating comparative studies of the different operators

The report by Lempert,[11] in 1945, and of Sullivan,[12] in the same year, suggested a division of the cases into four groups, namely *1* Complete rehabilitation *2* Partial rehabilitation *3* No change *4* Those cases which became worse A category of four such groups was suggested by Altmann and Woodman,[1] in 1918, in which they emphasized the importance of the 2018 frequency in those cases classified as partially rehabilitated

A recent personal communication was received in answer to an inquiry from Dr Philip Meltzer,[17] who is a member of the committee appointed for the purpose of establishing criteria for reporting the end-results of fenestration cases He stated that it had been suggested that a subdivision of the partially rehabilitated cases be made into two classes depending upon the decibel gains in the critical frequencies

Our own cases were divided into four groups This grouping follows somewhat the suggested pattern of the aforementioned operators This survey of hearing results was compiled from 50 cases, all at least one year old and some over three years postoperation Their average time was 22 months after operation

The cases were grouped as follows

Group I All cases which had improved to 30 db or better in the critical frequencies These cases were considered to be economically and socially completely rehabilitated

Group II All cases which had improved above the preoperative level but not to the full degree of Group I

- *a* Where there has been more than 10 db and less than 15 db average improvement for the critical frequencies
- *b* Where there has been 15 db or more improvement for the critical frequencies but not reaching the level in Group I

Group III Cases where the hearing is unchanged or does not show more than 10 db gain in the critical frequencies are reported as "unchanged"

Group IV Cases where hearing became worse by 10 db or more than the preoperative level in the critical frequencies

Results summarized Group I, 34 per cent Group II, *a* 10 per cent, *b* 16 per cent—26 per cent Group III, 26 per cent Group IV, 14 per cent

Groups I and II, representing the complete and partially rehabilitated cases, totaled 60 per cent of the series

BONE CONDUCTION IN THE OPERATED EAR

Some gain in bone conduction was recorded from the operated ear for 85 per cent of all the rehabilitated cases (Groups I and II).

Comparison was made between the preoperative and the twelfth month postoperative audiograms.

The average gain for all cases was 7.4 db for the three critical frequencies. The greatest gain was most often registered in the 1024 frequency, followed by the 2048 frequency. Juers[18] shows a bone conduction gain in these frequencies of 6.7 db in a group recorded three months after fenestration. He also noted the 1024 and 2048 frequencies as showing the greatest decibel gain. R. R. Woods,[19] of Dublin, recently reported on bone conduction gain following the fenestration operation. In a small series of five early cases he found a 14.2 db gain in the critical frequencies. In our series, 46 per cent of the cases showed an average of 14 db gain.

THE CONTRALATERAL EFFECT

Following the fenestration operation, some patients claim that they hear better in the unoperated ear than they did prior to their operation. This same phenomenon has been observed by Sourdille,[6] Kopetzky,[20] Holmgren,[21] Venker[22] and others.

Although we have not obtained frequent early audiograms of patients who claim they hear better in the unoperated ear, our own voice tests and the patients' reaction to sounds not heard before has been rather convincing that in some cases there is an improvement for air conduction in the unoperated ear.

The patient may insist on this improvement being present a day or two after the operation when and in spite of the fact that the operated ear is packed and a complete mastoid dressing and bandage covers the operated ear. Holmgren[21] and Sourdille stress this phenomenon as being present early but not being of a lasting quality.

Sourdille[6] stated "In the case of the nonoperated ear, a certain number of patients consistently, after opening the labyrinth and for a few days after, have a notable improvement in the nonoperated ear Does this represent an ear to ear reflex? Is this the result of a trophic or vascular reaction? This change for the better is generally of short duration and is generally followed by a progressive loss In certain cases, however, this opening of the labyrinth seemed to curtail the progressive loss in the unoperated ear This phenomenon is of interest only if we are able to show that the reaction of the nonoperated ear is really the result of the work done on the first ear"

Holmgren[21] noted a few cases with early improvement which he confirmed with voice and tuning fork tests and found a gain for both air and bone conduction

The fact that this subjective sense of improvement seemed associated with the early postoperative phase only might be explained by the fact that the operated ear, while undergoing dressings and postoperative repair, with the attendant accumulation of secretions, had not reached sufficient level of improvement to take over the hearing and become as it does later, when improvement occurs, the ear with which the individual focuses his attention on sounds Once the operated ear is the better ear, the subjective sense of any hearing improvement in the unoperated ear would be expected to disappear

Kopetzky,[20] in 1939, commented upon the presence of a contralateral effect and stated that "The cortical centers might be stimulated by the reactivation of the operated ear and cause an increase in sensory perception in the unoperated ear" This would imply a tonic effect on the cochlear nuclei The fact that it is subjectively short lived would make it look like a compensatory action until the operated ear improves and takes over

Venker,[22] in a series of 12 fenestration cases, reports audiograms showing improvement in hearing in the unoperated ear He seeks an explanation of this in the otosclerosis theory of Gray He reasons that the fenestration allows greater volume of sound to penetrate into the cochlea so that the stimulus for the vasomotor system becomes more intense The unilateral stimulus has its effect on both ears due to the fact that the sympathetic fibres of both originate in the plexus covering the circle of Willis He states the proof of this is seen in the vascular improvement noted in the drum of the unoperated ear

The insistence on the part of the patients of early improvement in the unoperated ear seems, in a few cases, to be accompanied later on by an actual gain in pure tone tests of bone conduction in the unoperated ear

The cases used for the study of postoperative bone conduction were those of Groups I and II of this survey, these being the cases which were considered partially or completely rehabilitated Averages were obtained by taking three of the postoperative periodic audiograms, including the twelfth month audiogram All frequencies between 256 and 8190 were included

Some improvement in bone conduction in the unoperated ear was noted in 86 per cent of the cases Both Fowler[23] and Holmgren[24] caution against errors resulting from repeated testing, also the subjects' psychological desire to hear better and hence concentrate better These factors may well account for many of the cases which showed only slight improvement, but there remain a few cases, approximately 15 per cent, with an average decibel gain of 13 5 in the unoperated ear Even though this is a relatively small percentage, it would seem there are cases which show a definite gain in bone conduction in the unoperated ear which has lasted for a twelvemonth period

Are these findings the result of repeated testing and the psychological desire on the part of the patient to hear better or is there some tonic action along the cochlear pathways which travel from the operated labyrinth to both the homo- and contralateral temporal lobes and then on to the contralateral labyrinthine nuclei?

The work of Walzl[illegible] has demonstrated that there are definite pathways between each cochlear labyrinth and its home and contralateral temporal lobe. He shows that there is a spatial frequency localization in the cochlea and that the pattern set up in the cochlea by a sound is projected to dual auditory areas in each hemisphere. McCulloch[20] has also demonstrated the localization of the point to point interconnecting pathways from one auditory cortex to the other via the corpus callosum.

In the case of the vestibular component of the VIIIth nerve, the effect of tonic impulses from one temporal lobe affecting the opposite vestibular nuclei has been demonstrated on animals by the work of de Barenne, Dusser and de Kleyn. These findings were later applied to the diagnosis of cerebral *lesions in work on humans by de Kleyn and Versteegh.*[8]

Further confirmation of this work in humans by the application of the caloric tests which demonstrated the value of the directional preponderance of caloric nystagmus as a diagnostic finding in temporal lobe lesions has been reported by G. Fitzgerald and C. S. Hallpike.[29]

Cawthorne, Fitzgerald and Hallpike[30] discuss the compensatory mechanism of Bechterew in which the vestibular nuclei take over and compensate for the loss of tonic impulses resulting from a utricular paresis which follows labyrinthectomy. They demonstrate that any depressing or paralytic effect on the utricle is *followed* by a preponderance of caloric nystagmus to the side of the normal labyrinth.

We might ask the question as to why the effect of definite improvement (13.5 db bone conduction gain) is no more frequent than in 15 per cent of the rehabilitated cases. Is the contralateral effect only an early one and are these few cases which showed lasting bone conduction gain those that just happened to be tested at times in which the phasic reactions were favorable? It is known that in tests of preponderance reactions of the vestibular nuclei, the phasic quality shows great variability, depending on the time tested after labyrinthectomy (see Fig 4) This phasic variability, characteristic of the compensatory activity of the vestibular nuclei, might account for the considerable variation in bone conduction testing postfenestration, if any analogy between the vestibular and the cochlear nuclei can be applied

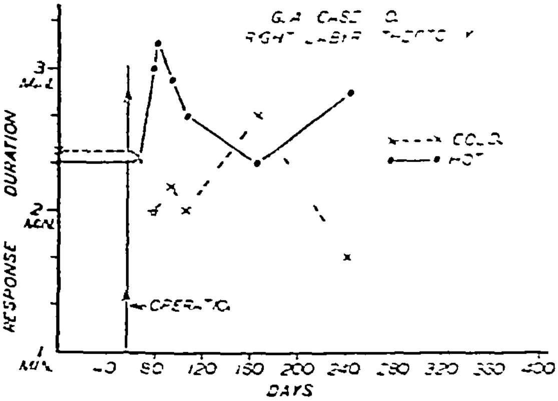


Fig. 3. Case 1. Course of caloric reactions before and after right labyrinthectomy (From Brain Vol. 65 1942.)

COMMENT

My impression is that there is a definite early improvement of hearing in the unoperated ear This effect would seem to me to be a central tonic response to the stimulation caused by the fenestration operation This effect is compensatory and transient in character

The few cases of bone conduction gain of lasting nature may be explained as being coincidental If they are the result of some central tonic action, then the reason for their being so few in number may be based on the already mentioned phasic quality of postoperative testing similar to that noted in preponderance tests of caloric nystagmus resulting from stimulation of the vestibular nuclei It is of interest that those cases which showed a lasting bone conduction gain were not always cases which had noted an early subjective improvement

The weight of evidence is not strong enough to merit any definite conclusion The series is too small, even though the evidence is suggestive of such a tonic action on the part of the cochlear nuclei being a possible etiological factor in producing contralateral improvement Further studies of this particular problem in a larger series of cases with more frequent audiometric tests, carried on in the early as well as the later postoperative period, may help either to elaborate upon or eliminate any such theoretical explanation

SUMMARY

1 The history of the development of the fenestration operation is reviewed

2 A survey of the experiences during the past three and one-half years with 75 cases is presented, describing the method and modifications used, together with postoperative care

3 The complications encountered and their sequelae are noted, together with an autopsy report with histological findings in the temporal bone

4 One case showing the effect of infection on postoperative hearing is presented with table of the decibel average for critical frequencies before and after the removal of the infection

5 The method of reporting *the end-results* of fenestration operations is discussed and the four classified groups used in this survey are described

6 Improvement in bone conduction in the operated ear is mentioned and compared with similar findings and results of other operators

7 The contralateral effect of improvement in the unoperated ear has been recorded by Sourdille, Kopetzky, Holmgren, Venker and others

8 Sourdille and Holmgren have reported this effect as only early and transient

9 Holmgren reported contralateral improvement for both air and bone conduction checked by tuning fork tests

10 Our own experience resulted in many cases which presented this early subjective contralateral improvement, together with a small group (15 per cent) which showed a definite (13 5 db) improvement in bone conduction which lasted during the first 12 months

11 The contralateral and homolateral pathways to the cerebral cortex have been demonstrated by the recent work of Walzl

12 The contralateral effect in the case of the vestibular component of the VIIIth nerve has been demonstrated by the work of Cawthorne, Fitzgerald and Hallpike

13 An attempt is made to draw an analogy between the tonic contralateral effect as seen in the case of the vestibular component and apply a similar explanation to the effect on the cochlear nuclei and their contralateral pathways which follows the fenestration operation

14 Our impression is that the early transient contralateral effect is a central tonic effect resulting from the fenestration operation and that this is of a compensatory character

15 The lasting bone conduction improvement noted in a few cases is regarded as coincidental or possibly the result of a phasic variability similar to the compensatory activity of the vestibular nuclei following labyrinthectomy The latter is explained on the basis of the Becterew mechanism

16 This series is too small for definite conclusions, but the results strongly suggest a central tonic contralateral effect The attempt to explain this by drawing the analogy between the vestibular and cochlear components of the VIIIth nerve may be elaborated upon when studied in a larger series with more frequent audiometric testing for both the early and late postoperative stages

BIBLIOGRAPHY

1 BARANY, R Die Indikationen zur Labyrinthoperation *Acta Otolaryngol*, 6 260, 1924

2 KESSEL, J *Arch f Ohrenh*, 11 199, 1876

4 PASSOW, A. *Verhandl d. deutch otol Gesellsch*, 6 141, 1897

4 JENKINS, G J *Jour Laryngol and Otol*, 29 520, 1914

5 HOLMGREN, G Surgical Therapy in Otosclerosis Loose Leaf Surgery of the Ear Ed by S Kopetzky New York Thos. Nelson & Sons, 1938, p 399

6 SOURDILLE, M Traitement Chirurgical de L'Otospongiose Paris Chantenay, 1935

7 LEMPERT, JULIUS Improvement of Hearing in Cases of Otosclerosis, a New One Stage Surgical Technique *Arch Otolaryngol*, 29 42 97, July, 1938

8 LEMPERT, JULIUS Fenestra Novovalis *Arch Otolaryngol*, 34 880-912, Dec, 1941

9 WHITAKER, C E, JR, JUERS, A. L., and SHAMBAUGH, G E, JR. A Modified Endaural Incision with Nerve Block Anesthesia for Fenestration and Mastoidectomy *Arch Otolaryngol*, 47 662 667, June 1947

10 HOUSE, H P The Fenestration Operation *Ann Otol Rhinol and Laryngol*, 57 41 54, Mar, 1948

11 LEMPERT, JULIUS Bone Dust Free Fenestra Novovalis *Arch Otolaryngol*, 47 280-288, Mar, 1948

12 SHAMBAUGH, G E, JR. A Modified Fenestration Technique *Arch Otolaryngol*, 36 23, July, 1942

13 FOWLER, E P, JR Closure of Operative Fenestra in the Labyrinth *Arch Otolaryngol*, 34 209 224, 1941

14 LEMPERT, JULIUS *Arch Otolaryngol*, 41 1, Jan 1945

15 SULLIVAN, J A. Indications for, and End Results of Fenestration Operation *Canad Med Assn Jour*, 53 543 Dec, 1945

16 ALTMAN, F, and WOODMAN, DE GRAAF Otosclerosis Its Pathology and Treatment *N Y State Jour Med*, Vol 43, Jan 15, 1948

17 MELTZER, PHILIP E Personal communication

18 JUERS, A L Observations on Bone Conduction in Fenestration Cases *Ann Otol, Rhinol and Laryngol*, 57 28-40, Mar 1948

19 WOODS R. R. Some Observations on Bone Conduction Following the Fenestration Operation *Jour Laryngol and Otol* 62 22-32 Jan 1948

20 Kopetzky, S J Discussion to Campbell. *Tran Amer Acad Ophth and Otolaryngol.*, 44 278-299, 1939

21. Holmgren, G Otosklerose—Chirurgie *Prac oto-rhino-laryngol* 8 441-445, 1946

22 Venker, J Some Remarks on the Fenestration Operation and What Leads to the Results. Thesis published in Amsterdam 1947 and quoted from *Excerpta Medica Sec XI*, 1 289, 1948

23 Fowler, E P Jr Extraneous Factors in Quantitative Tests for Hearing *Acta Otolaryngol*, 28 283-304 1940

24 Holmgren, G Surgical Therapy in Otosclerosis Surgery of the Ear Ed by S J Kopetzky New York Thos Nelson & Sons 1938 pp 398-430

25 Walzl, E M Cochlear Representation in Cortex The Laryngoscope, 57 778-787, Dec., 1947

26 McCulloch, W S The Functional Organization of the Cerebral Cortex. *Physiol Rev* 24 390-407 1944

27 de Barenne J G Dusser and de Kleyn A. v *Graefes Arch Ophthal.*, 111 374, 1923

28 de Kleyn, A. and Versteegh, C R J *Jour Laryngol* 42 649 1927

29 Fitzgerald, G and Hallpike, C S *Brain* 65 115-137 1942

30 Cawthorne, T E Fitzgerald G and Hallpike, C S *Brain.* 65 138-160 1942

SURGICAL REPAIR OF CONGENITAL CHOANAL ATRESIA

J EASTMAN SHEEHAN, M D , and WILSON A SWANKER, M D ,
New York, N Y

Definition In congenital atresia of the choana narium, a persistent wall of tissue obstructs the posterior infundibulum The atresia may be unilateral or bilateral, partial or complete In 90 per cent of cases the obstructive wall is osseous in nature,[1] it may, however, be membranous or combine both characteristics Otto[2] first described the condition in 1829

Complete bilateral atresia constitutes a pediatric emergency it is impossible for the infant to suckle and respiration is seriously impeded Richardson[3] reported a case of asphyxia neonatorum due to this cause

Fortunately this extreme type is rare Even in its unilateral or incomplete form, however, choanal atresia inhibits normal development by interfering with respiration and alimentation

Anatomy The choana narium is bounded inferiorly by the horizontal plate of the palatine bone, medially by the posterior border of the vomer and the nasal crest of the palatine bone, superiorly by the vomerine ala and the body of the sphenoid, and laterally by the median plate of the pterygoid process of the sphenoid bone and the perpendicular plate of the palatine bone In the lateral wall lies the pterygopalatine canal containing the palatine artery and nerves

Etiology The factors responsible for choanal atresia have yet to be definitely proved According to the prevailing opinion, the abnormal tissue is the vestige of one of two

---

Editor s Note This ms received in Laryngoscope Office and accepted for publication Sept 3 1949

fetal structures the bucconasal or the buccopharyngeal membrane[4,5,6] The anteriorly located osseous obstruction is thought to arise from the bucconasal membrane, the more posterior, membranous type from the buccopharyngeal

A less generally accepted theory holds that the atresia results from an overgrowth of the horizontal and vertical processes of the maxilla Boyd defended this hypothesis by pointing out the presence of islets of cartilage in the bone these would not be present in bone formation from the mesenchyme within the membrane, however, this hypothesis fails to explain the localization of the obstruction or the fact that the membranous type is usually more posteriorly located than the osseous

Stewart[7] believed both theories would have to be drawn upon for a complete explanation The condition is aggravated by sinusitis or other irritants

Symptoms and Diagnosis In complete bilateral occlusion, severe asphyxial symptoms facilitate diagnosis, the infant is cyanotic, with cheeks and lips indrawn Temporary relief occurs on crying, when breathing is automatically carried on through the mouth Suckling is impossible and the child must be fed by medicine dropper until it learns mouth breathing or surgical relief is obtained

While unilateral occlusion presents less sensational symptoms, it also interferes with respiration and nursing During the latter the child must be held with the occluded nasal fossa in an inferior position

The presence of a suspected obstruction can be verified by exploration of the nasopharynx and posterior nares with the finger A probe passed into the nasal fossa ascertains the precise location of the atresic wall and the degree of impermeability By blowing air through the nostrils with a rubber bulb, the patency of the nasal passages is determined

On examination with the nasopharyngoscope or laryngeal mirror, the bony type of obstruction appears white, while the membranous (or the membranous center in the membrano-osseous type) appears translucent and dappled The obstructed nasal fossa is usually filled with a sticky mucus substance which can be expressed from the nostril

The obstruction can be demonstrated Roentgenologically by the instillation of lipiodol into the nasal fossae[8] In cases of unilateral occlusion there is usually a marked septal deflection toward the obstructed side[9] The septum tends to comparative straightness in bilateral atresia

Differential Diagnosis Choanal atresia is readily differentiated from other intranasal obstructions While large adenoids may cause partial stenosis in the infant, they do not

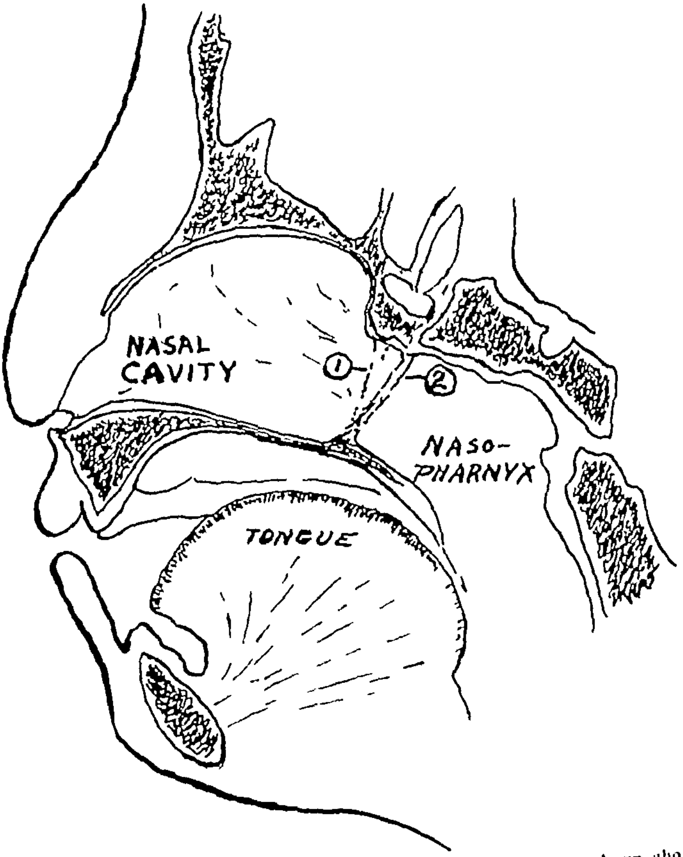


Fig 1 Schematic diagram of a section of the head of a newborn showing (1) location of a typical osseous occlusion and (2) location of a typical membranous occlusion of the nasal choana.

produce complete occlusion It is interesting to note that adenoids are usually absent in bilateral atresia, but Geiger and Roth[10] reported their presence in a case of unilateral occlusion

Pyhsical examination suffices to distinguish choanal atresia from such other obstructions of the posterior nares as congenital postnasal polysp and encephalomenigoceles This is true also of blood clots and other products of birth which

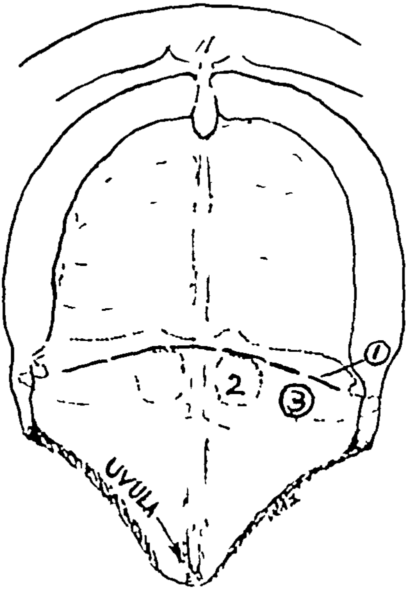


Fig 2 The oral palate (1) Line of incision in the palatine mucosa (1) Fenestration of the os palatinum (3) Os palatinum outlined in dotted lines

may have been pushed or drawn into the nostrils during delivery Congenital atresia of the nasopharynx may simulate postnasal imperforation, but here again examination will dispel any doubt

Surgical Repair The surgical repair of choanal atresia dates back to 1853, when Emmert[11] operated successfully on a seven-year-old boy Since then many methods have been employed to eliminate the obstruction

If an emergency the atresic wall, whether osseous or membranous, can be perforated to permit nasal breathing No matter how large the opening made, however, it has a tendency to close on cicatrization Morgenstern resorted to repeated excisions to maintain the fenestra

The obstruction can be attacked anteriorly by the intranasal route[12-17] or posteriorly by the nasopharyngeal Morgenstern approached it from both directions, using surgical diathermy

When the size of the anterior nares and nasal fossae of the infant is considered, it is apparent that the intranasal approach leaves much to be desired The surgical field is uncomfortably confined and the desired correction cannot be carried out under direct vision There will of necessity be a large area of scar tissue, with resulting adverse effects on physiological function

While the Kazanjian trans-septal operation largely overcomes these objections, extensive septal surgery is inadvisable in the infant in view of its possible effects on the developmental processes of the nose Similarly, one hesitates to invade the infant antrum, as in the transantral method of Wright, *et al*[18]

The more expeditous transpalatine route was used by Blair,[19] Steinzeng,[20] Schweckendiak,[21] Neto[22] and Ruddy[23] Their techniques vary in the position of the incision and the amount of hard palate removed Blair's incision — from the anterior part of the palatal mucosa to the junction of the hard and soft palates — seems unnecessarily long Steinzeng raises an exceedingly large flap, embracing almost two-thirds of the palatal mucosa Schweckendiak and Neto make an I-shaped incision in the posterior third of the hard palate and raise two lateral flaps Ruddy's incision follows a horizontal flat arc, starting just medially to the orifice of the posterior palatine canal on one side and extending to the same point on the other He raises a posterior flap with very good exposure Both Neto and Ruddy penetrate the hard palate in two places, on either side of the septum (vomer) The operation is then performed through the nasal submucosa This approach permits a double attack upon the obstruction as the intranasal route may be used as a supplement

Following excision of the atresic wall, the edges of the nasal mucosa can be dropped in place as in Ruddy's technique, or flaps of mucosa can be transposed as in one of Blair's methods, or a split skin graft can be transplanted to the raw area[24] The transpalatine procedure of choice would combine Ruddy's incision, Neto's fenestration and Blair's treatment of the nasal mucosa, as follows

Step 1 Palpate the orifices of the two posterior palatine canals (These feel like two soft spots in the hard palate, just medial to the upper third molars)

Step 2 Incise the palatine mucosa and periosteum in an anterior arc between these two points

Step 3 Elevate a posterior flap subperiosteally for about 1 to 2 cm

Step 4 Locate the atresic wall and remove sufficient palatine bone from either side of the midline to facilitate the attack on the obstruction

Step 5 Remove the entire obstruction, through the nasal submucosa insofar as possible (A small blunt instrument, inserted into the nasal fossa, expedites this step)

Step 6 Excise redundant mucous membrane or transfer mucosal flaps to defect

Step 7 Insert rubber obturator of as large diameter as possible into nasal fossa to hold the tissues in place

Step 8 Cut a piece of gelfoam to fit the palatal defect Insert into defect

Step 9 Close the incision in the palatine mucosa with interrupted catgut sutures

Several types of obturators have been suggested, such as stent, tin, rubber,[25] medicated gauze strips[2] and acrylic[7] One of us (Sheehan) prefers stent as it is always available, readily molded, nonirritant and not easily affected by body heat It should be mixed one-third white and two-thirds brown as the white gives added stability to the mold

Rubber also is efficient and easily obtainable, old catheters can be used When the rubber-tube obturator is employed, it should be slid back and forth gently each day

Obturators are dispensed with after two weeks It cannot be overemphasized that adroit after-care is the most important single feature of treatment

CONCLUSIONS

1 It is fairly well established, though not definitely proved, that congenital choanal atresia arises from the bucconasal or buccopharyngeal membrane

2 While slightly more difficult in some respects, the transpalatine route affords the most satisfactory surgical approach

BIBLIOGRAPHY

1 Libensohn, J E Congenital Atresia of the Postnasal Orifices *Ann Otol, Rhinol and Laryngol*, 32 1128, Dec, 1923

2 Otto, A. W Handbuch der pathologischen Anatomie des Menschen und der Thiere Breslau J F Barth, 1814, p 203

3 Richardson, C W Congenital Occlusion of the postnasal Orifices *Trans Amer Laryngol Assn*, 35 226, 1913

4 Boyd, H W Congenital Atresia of the Posterior Nares *Arch Otolaryngol*, 41 261, Apr, 1945

5 Morgenstern, D J Congenital Atresia of the Postnasal Orifices. *Arch Otolaryngol*, 31 653, Apr, 1940

6 Shaeffer, J P Congenital Atresia of the Nose *Trans Amer Laryngol Assn*, 56 126, 1934

7 Stewart, J P Congenital Atresia of the Posterior Nares *Arch Otolaryngol*, 13 570 Apr 1931

8 Beyer, T E, and Blair, J R Choanal Atresia. The Laryngoscope, 57 719, Nov, 1947

9 Asherton, M Bilateral Congenital Occlusion of the Posterior Choanae Due to Membranous Diaphragm *Jour Laryngol and Otol*, 45 344, May, 1930

10 Geiger, C W and Roth J J Osseous Choanal Obstruction and Adenoid Tissue *Arch Otolaryngol*, 15 441, Mar, 1932

11 Emmert, C F Lehrbuch der Chirurgie Stuttgart F v R Dann 1853

12 Katz, L Preysing, H, and Blumenfeld, S Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege Wurtzburg Curt Kabitzsch, 1911-1913, 3 432

13 Kazanjian, V H The Treatment of Congenital Atresia of the Choanae *Ann Otol, Rhinol and Laryngol* 51 704 Sept. 1942

14 Kloff, D D Bilateral Congenital Atresia of the Choanae *Arch Otolaryngol*, 41 298, 1945

15 Schwartz, A A and Isaacs H J Congenital Atresia of the Posterior Nares Report of Two Cases *Arch Otolaryngol*, 35 603 Apr 1942

16 Hubbell, A A. Congenital Occlusion of the Posterior Nares *Trans N Y Med Assn*, 3 245 1887

17 Pastore, P N, and Williams, H L Congenital Occlusion of the Nasal Choanae Brief Review of 12 Cases *Proc Staff Meet Mayo Clin* 14 625 Oct., 1939

18 Wright Wm K., Shambaugh, G E Jr. and Green L Congenital Choanal Atresia A New Surgical Approach *Ann Otol Rhinol and Laryngol*, 56 120, Mar, 1947

19 Blair V P Congenital Atresia or Obstruction of the Nasal Air Passages *Ann Otol, Rhinol and Laryngol*, 40 1021 1931

20 Steinzeng, A Surgical Technique for the Removal of Choanal Coalescences *Arch f Ohren, Nasen u Kehlkopf* 137 364 1933

21 Schweckendiek, H Transpalatinale Behandlung angeborener Choanalatresien (mit Vorweisungen) *Ztschr f Hals Nasen u Ohrenheilk* 42 367 1937

22 Neto, J R Transpalatine Route in Therapy of Bilateral Congenital Imperforations of the Choanae with Report of Cases *Rev Brasil de Oto-rino-laring*, 10 431 1942

23 Ruddy L W A Transpalatine Operation for Congenital Atresia of the Choanae in the Small Child or the Infant. *Arch. Otolaryngol* 41 432 June, 1945

24 Donnelly, J C Congenital Atresia of the Posterior Nares *Arch Otolaryngol* 1928 112 July 1938

25 Shearer W L. Atresia or Stenosis of the Nares *Neb Med Jour* 32 116 Mar, 1947

26 Brady, A. J Atresia of the Choanae a Simple Device for the Prevention of Reformation of the Obstruction After Its Removal *Jour Laryngol* 33 49 Feb 1918

27 Wilkerson, W J and Cance, L. F Congenital Choanal Occlusion *Trans Amer Acad Ophthal and Otolaryngol* pp 234 246 Jan Feb 1948

DETECTION OF NOISE SUSCEPTIBLE EARS*

D E Wheeler, Ph D ,
Iowa City, Iowa

INTRODUCTION

In the literature, frequent reference is made to the fact that different individuals exposed to the same amount of noise display different degrees of resultant hearing loss Such findings clearly imply differences among individuals in susceptibility to noise-induced trauma Stated simply, if two individuals, A and B, are exposed to the same noise for the same length of time, A may develop a significant and permanent hearing loss, whereas B may not

The locus of loss, when it occurs, is no longer in doubt Many studies exist to show that noise trauma is related to alterations in cochlear structures Although the bulk of the evidence is drawn from animal studies, there is no reason to doubt its application to the human ear In one of the most recent publications on this subject, Ruedi and Furrer[6] have shown histological evidence, in fresh postmortem sections, of severe damage to human ears following exposure to blast Hemorrhage within the internal ear and bleeding from the canal, together with demonstrable disruption of cochlear elements, are probably evidence of irreversible impairment in the portion of the auditory range damaged by explosion, blast,

---

*From the Department of Otolaryngology and Oral Surgery State University of Iowa Hospitals Iowa City Iowa

Editor's Note This ms received in Laryngoscope Office and accepted for publication July 11 1949

concussion, etc. Survivors of such episodes usually display a hearing loss as determined by functional tests, but these individuals sometimes show a recovery of some fraction of the loss when their audiograms are followed over a sufficient length of time. Individuals who work in noisy environments, such as factories, develop hearing losses which, on the average, are proportional to the intensity level of the noise and the length of time of exposure to the noise. Individuals having normal hearing who are temporarily exposed to high sound levels develop a loss which disappears not long after termination of the exposure.

All of these considerations indicate that noise exposure probably initiates a continuum of events, ranging from a reversible temporary loss for short exposures at moderate levels to a permanent irreversible loss induced by exposure to excessively intense sound pressures, such as those produced by blast, explosion or concussion. The most challenging aspect of the above summary is the determination of the point at which the loss ceases to be reversible and becomes a permanent impairment. It is precisely this determination which is involved in the matter of susceptibility, since prediction of susceptibility obviously implies prior knowledge about a nonexistent loss which will become manifest as the result of noise exposure.

THE MECHANISM OF IMPAIRMENT

It has been brought out that actual histological damage can be demonstrated under extreme exposure conditions and the hypothesis is made that such damage is irreversible. Functional tests, however, demonstrate the reality of reversible losses. The question may now be raised as to the physiological basis for a reversible loss. An excellent paper by Hamberger and Hyden[1] gives one such mechanism in explanation of this phenomenon. These experimenters exposed a series of animals to sound pressures graded in level and duration of exposure time. In postmortem sections they studied alterations in the nuclei of cochlear ganglion cells. These alterations were demonstrated by delicate biochemical and biophysical techniques, utilizing absorption spectra, ash residue and dye indicators Their results may be summarized as follows intensity and exposure time are directly related to corresponding depletion of specific protein compounds in the cell nucleus and nucleolus Norms were established for the concentration of these substances in unexposed ears It was shown that animals surviving 21 days following the exposure period had cells of normal concentration, those sacrificed in intervening periods had concentrations varying with elapsed time In a later series of experiments, Hamberger and Hyden demonstrated that the conditions which produced these metabolic changes also produce functional hearing losses A strong relationship between this particular aspect of cell metabolism and functional response is certainly suggested The logical deduction from this research is that functional losses become irreversible at some point in the process where the resting cell is no longer capable of restoring the normal concentration of protein compounds

It is, of course, not possible to state with certainty that the phenomena described above completely explain the mechanism of reversible or irreversible impairment in the human ear The temporary threshold shift demonstrated in humans following noise exposure usually returns to normal threshold after a few hours and, at most within three to four days, whereas the metabolic changes studied by Hamberger and Hyden in the guinea pig were detectable up to almost three weeks following exposure, with maximum depletion at 14 days

INDICES OF SUSCEPTIBILITY

It is probable that every ear when exposed to a sound of sufficient intensity over a period sufficiently long in duration will undergo some functional loss in acuity The degree of loss varies widely in individuals, as previously stated There appears to be, therefore, a continuum which, for a sound of given intensity level and length of exposure, includes all individuals ranging from those who show only slight losses in acuity and rapid recovery to those who show large losses and long periods necessary for recovery

In this paper, attention is focused upon the latter end of the continuum The noise susceptible ear, in this context, is obviously one which displays significantly large losses of acuity in response to noise exposure and requires a long time for recovery to normal When the *recovery time* required approaches infinity, this ear has undergone a permanent and irreversible decrement in acuity In the industrial world, an individual having such an ear should not be exposed- to high noise levels for long periods, if he is so exposed, he will unquestionably suffer permanent loss of acuity in some or all portions of the auditory range That such noise susceptible individuals exist is a fact amply confirmed by repeated observation and by reports in the literature, that such an individual can be identified prior to the actual establishment of the loss is, however, an hypothesis yet to be confirmed

Peyser,[3] writing on this subject in 1940, advanced the idea of test bombardment with subsequent threshold shift as an index of susceptibility His original test consisted of two thresholds at 256 cycles, one taken prior to exposure at that frequency for five minutes, the second threshold measured 30 seconds after cessation of the exposure tone Peyser claimed that individuals whose second threshold was 5 db or more higher after exposure were noise susceptible No validation of this claim was shown, in his paper, by tests of these "susceptible" ears under actual noise conditions Wilson[4] applied Peyser's principle in studying soldiers before and after exposure on rifle and pistol ranges He used an 80 db exposure tone of 256 cycles with a maximum duration of eight minutes delivered by a Western Electric 6A Audiometer, the entire audiogram (nine frequencies) was measured both before and after exposure to the 256 cycle tone Wilson considered shifts of 10 db or more at any frequency as a criterion of susceptibility Out of 85 subjects, 27 showed susceptibility (according to this criterion) by the audiometer test All 85 subjects were next sent to the firing range, of the 27 predicted to be susceptible by advance testing, 21 showed criterion loss or greater after retesting following exposure to rifle and pistol noise Ten other subjects not predicted susceptible also showed criterion loss or greater In a later series of experiments, Wilson[9] used 2048 cycles at 80 db for eight minutes as the exposure tone and studied a group of 108 soldiers, his results, so far as prediction is concerned, were approximately the same as those of his original study Wilson concluded that practical predictive test can be constructed by careful selection of an appropriate exposure tone

Peyser[4] has revised his original procedure and now advocates an exposure tone of 1000 cycles at a level of 100 db for three minutes The 100 cycle threshold is measured first, then the ear is bombarded for three minutes, 15 seconds after cessation of the exposure tone, the 1000 cycle threshold is redetermined Peyser considers that ears which show shifts of none to 5 db as a result of this test are resistant to noise, ears which show 5 to 10 db shifts are borderline, and ears which show 10 db or greater shifts are "hypersensitive" or susceptible to noise impairment In Peyser's paper, no data showing the subsequent effects of industrial noise on these ears are given

Investigators writing on the subject of noise impairment[2 4 8] usually regard an already existing hearing loss as contraindicative to the advisability of noise exposure Although there is some question about this point when it involves middle ear type losses, there seems to be general agreement regarding individuals with inner ear pathology Larsen[2] says

"Last, but not least, an important prophylactic measure is the selection of laborers who shall work in a noisy shop Persons who suffer from a disturbance of perception ought not to be employed in a noisy works, for it must be anticipated that a debilitated sense organ responds far more rapidly, more intensely, more extensively, and under easier fixation of the injury, than does the sound (normal) ear The same applies to laborers presenting predisposition to ear disease As was mentioned before, they will likewise react more readily to the influence of noise than normal persons"

PREDICTIVE TESTS

The methods described by Wilson and Peyser have been given added importance by Hamberger and Hyden, in that a physiological basis has been supplied by the latter authors, but the future development of an accurate predictive test depends upon careful standardization of technique

It appears that the test bombardment of ears, followed by measurement of the resulting threshold shift, will form the basic technique in a predictive test The first question to be resolved in the establishment of a standardized test is the selection of the stimulating or bombarding sound Nearly all of the many studies reported in the literature have been conducted with pure tone stimuli, unless repeated audiograms are to be taken, one must obviously choose a single frequency as the stimulus in a predictive test Although the effects of exposure to a loud pure tone are not always confined to that frequency and/or immedately adjacent frequencies, there is always the possibility that any single pure tone may be too specific for use in a generalized predictive test A more obvious approach would be to bombard the entire auditory range simultaneously For this purpose, a suitable type of stimulus is available Thermal noise, or "white" noise, is an easily produced stimulus whose chief characteristic is statistical equality of energy at all frequencies in the auditory range Until more information is available about the results of predictive testing, the writer believes it more practical to employ a complex stimulus which allows no portion of the auditory range to "escape" exposure It is, perhaps, worth observing that industrial noises are always complex, in a test, thermal noise would have higher face validity than pure tones

The next question involves the frequencies to be studied in the postexposure audiogram The evidence from many reports in the literature leaves little doubt that the more vulnerable portion of the auditory range lies in the high frequency end, *i e*, above 1000 cycles Time is needlessly wasted, therefore, in measuring postexposure thresholds at low frequencies in a practical test of susceptibility For the time being, at least, it would be more profitable to concentrate attention on the 2000 to 8000 cycle range, with special consideration being given to 4000 and 6000 cycles It is in this region that large threshold shifts appear after short exposures

A third question is that of the criteria used to differentiate susceptible from nonsusceptible individuals It is suggested here that two measurements be considered

1 The magnitude of the threshold shift, *i e*, the number of decibels by which the postexposure threshold is elevated above the pre-exposure threshold

2 The recovery time, *i e*, the number of minutes required to elapse between termination of exposure and return to pre-exposure threshold Of the two measures, it is conceivable, that the latter will prove more highly differentiating than the former It was brought out in the preceding discussion that, when recovery time becomes infinite, permanent reduction in acuity has been established The temporary threshold shift is a transient phenomenon whose very title shows its dependency upon time It would be a comparatively simple matter to establish the normal rate of recovery of 4000 cycles, for example, to pre-exposure threshold, given the norm, one could consider individuals who display markedly retarded recovery rates as potentially susceptible

The fourth issue is that of test ventilation It will be useful here, perhaps, to recall the reason for predictive tests These are to be employed in segregating the *individual* who is noise susceptible In the industrial application of such tests, the administrator must have high confidence in the meaning of his results, for they might influence strongly the placement of the applicant for any job involving high noise levels. It is, therefore, necessary that any predictive test be shown to be valid by actual results in the field before such tests can be applied generally. The method of establishing validity is essentially that employed by Wilson, discussed in the preceding section of this paper. The test must be given in advance to a group of individuals about to take employment in a noisy environment. The hearing acuity of this group must be followed over the period of time necessary to establish significant, and presumably permanent, losses in certain individuals. If, then, these individuals are those predicted to be susceptible by the original test, and *if no individual not predicted susceptible* develops losses of the same order, the validity of the test will have been supported.

SOME PRACTICAL PROBLEMS

When the basis for predictive tests has been confirmed, as suggested above, there will remain the necessity for a standardized presentation. The critical application of such tests requires that as little room as possible be left for erroneous interpretation.

It will probably be necessary to take into account the tinnitus which usually follows when ears have been exposed to noise. Peyser comments upon this disturbance but says that his 1000 cycle exposure tone seems to produce tinnitus of a short duration, about 15 seconds. In a study of the temporary threshold shift, the writer exposed 12 normal hearing subjects to thermal noise at 105 db above reference level (.0002 dynes/cm²), these subjects reported the presence or absence of tinnitus following exposure and attempted to match its pitch on a variable frequency oscillator. Table 1 shows the frequency chosen as representative of the pitch of tinnitus by these subjects. Since tinnitus is probably not a pure tone in most subjects the frequency here should be regarded as specifying the region in which tinnitus typically occurs but not its exact frequency level.

TABLE 1

Subject	Frequency—C p s	Comments
1	500	Slight
2	900	Definite
3	——	None reported
4	5000	Fairly definite
5	——	"Buzzing"
6	3750	Indefinite
7	4500	Fairly definite
8	1000	Fairly definite
9	5200	Fairly definite
10	6000	Definite
11	7000	Fairly definite
12	10,000	"About"

The majority of these subjects experienced some tinnitus and, for the most part, indicated it to lie in the high frequency region of the audiogram, however, no subject reported tinnitus severe enough to interfere seriously with his judgment of threshold Since these subjects were not highly trained observers, it appears that tinnitus does not necessarily represent an insuperable obstacle to postexposure threshold measurement It is important, however, to note from Table 1 that tinnitus seems to occur most often in the frequency region proposed for predictive tests On this account, some provision ought to be made against its possible interference in a general predictive test The now familiar pulse tone technique[5] seems to be well suited As is known, this technique requires the subject to indicate how many tone pulses were heard at any given level Consequently, the examiner is able to check the threshold by means other than the subject's unsupported statement that he heard or did not hear the tone

In a previous paper,[7] the writer has discussed the need for careful control of time in predictive tests, because the temporary threshold shift is a transient phenomenon Fig 1 shows a circuit designed by the writer which will make possible a standardized presentation in which time is not only controlled but made the criterion of susceptibility

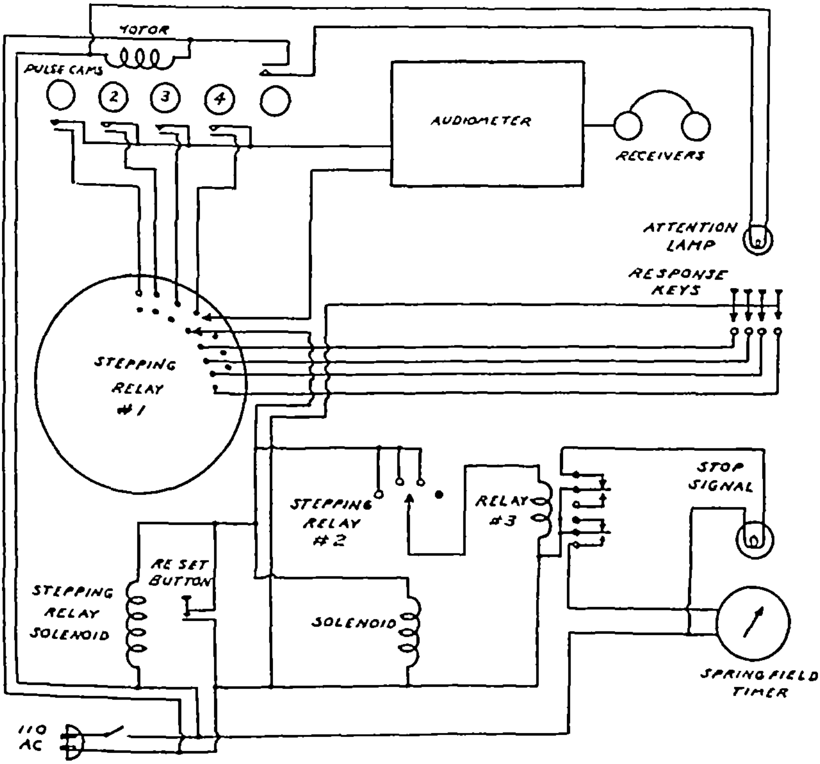


Fig 1

This circuit applies the pulse tone technique recommended above The test is intended to begin immediately following a standard exposure interval to thermal noise With the audiometer set at one of the recommended frequencies in the 2000 to 8000 cycle range, random patterns of pulse tones are automatically presented at the pre-exposure threshold level By pushing buttons numbered according to the pulse patterns, the subject registers which number he heard When the correct button is pushed, the stepping relay advances to a new pattern When the subject has correctly heard, and signaled, three consecutive patterns, the time is automatically stopped and the test ended The timer measures the time elapsed from beginning to end of test, *i e*, "recovery time," according to this criterion of recovery If this time falls within the normal range of recovery times, the subject will not be considered susceptible, if the recovery time shown is longer than the acceptable normal range, the subject will be considered noise susceptible

It should be pointed out that this type of test tends to minimize the inevitable differences in interpretation arising when thresholds are measured manually by different examiners, since, with this equipment, the examiner's task is confined to giving instructions and reading the timer Such a test could be applied by untrained examiners, if necessary, a situation likely to be true in industry where audiologists are not generally available

REFERENCES

1 HAMBERGER, C A, and HYDEN, H Cytochemical Changes in the Cochlear Ganglion Caused by Acoustic Stimulation and Trauma *Acta Otolaryngol*, Supp 61, 1 89, 1945

2 LARSEN, BORGE Investigations of Professional Deafness in Shipyard and Machine Factory Laborers *Acta Otolaryngol*, Supp 36, 9 151, 1939

3 PEYSER, A. Zur Methodik einer otologischen Prophylaxis der industriellen Lärmschwerhörigkeit *Acta Otolaryngol*, 28 443-462, 1940

4 PEYSER, A. Uber die für gewerbeotologische Belastungsprüfungen geeignete Frequenz *Acta Otolaryngol*, Supp 74 (Tranactions of the Tenth Northern Otolaryngological Congress), 131 135, 1948

5 REGER, S N and NEWBY, H A. A Group Pure Tone Hearing Test *Jour Sp Dis*, 12 61 66, 1947

6 RUEDI, L, and FURRER W Das akustiche Trauma *Prac Oto-Rhino-Laryngol*, 8 178 372, 1946

7 WHEELER, D E Noise-Induced Hearing Loss THE LARYNGOSCOPE (in press)

8 WILSON, W H Prevention of Traumatic Deafness *Arch Otolaryngol*, 37 757 767, 1943

9 WILSON, W H Prevention of Traumatic Deafness Further Studies *Arch Otolaryngol*, 40 52 59, 1944

HEMANGIOMA OF THE LATERAL BAND OF THE PHARYNX AND NASOPHARYNX
CASE REPORT*

W. W. WILKERSON, JR., M.D., AND LEE F. CAYCE, M.D.,
Nashville, Tenn.

Notwithstanding the fact that tumors of the nasopharynx are common, certain rare types challenge one's method of treatment and diagnostic ability, prior to biopsy.

In determining the diagnosis and methods of treatment of masses of this type, it is important that the following definitions are considered: hemangioma is a tumor composed primarily of blood vessels; lymphangioma has a preponderance of lymph vessels, while an angioma has cells which tend to form either blood or lymph vessels.

These tumors of the nasopharynx must be differentiated from the more common growths such as sarcoma, fibroma, endothelioma, carcinoma, chordoma, craniopharyngeal cysts as well as hypertrophy of the lymphoid tissue. Woodward[1] states that pseudoangiomas, that is, bleeding polypi, fibroangiomas and cirsoid aneurysms must be differentiated from true angiomas.

To my knowledge only two hemangiomas arising from, and limited to, the lateral pharyngeal band have been reported: one by Lillie[2] and another by Lichtwitz.[3]

Woodward,[1] Lillie,[2] Rosenberger,[4] Milligan[5] and others have also recognized the rarity of these tumors.

---

*From the Division of Otolaryngology, Vanderbilt Medical School, Nashville, Tenn.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication July 12, 1954.

With the exception of the possibility of trauma, the etiology, as in most other new growths, is unknown It might be pertinent to think of the basic etiologic factor as an embryological mal-development

Treatment, in general, is surgery, radiation, a combination of the two, or injection of a sclerosing agent The growths should be removed, and when feasible, during their incipiency One must be prepared to cope with extensive hemorrhages during any of the above procedures

CASE REPORT

A well developed female, age 19, when first seen was complaining of having had a full feeling in her throat for the past year As she had had no other symptoms, she procrastinated having an examination until she saw the growth in her throat.

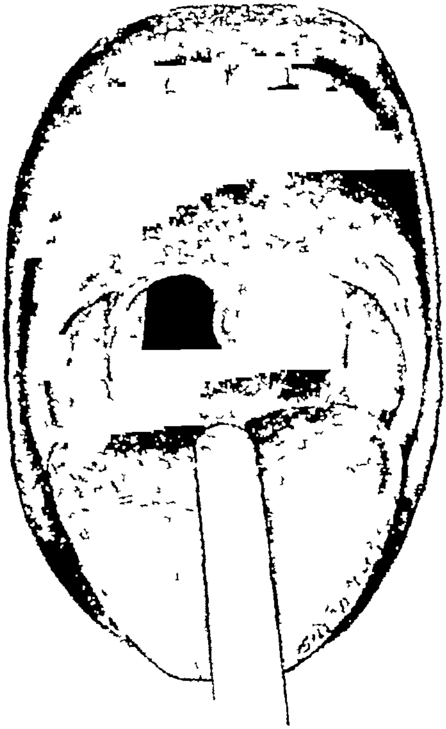


Fig 1 The primary tumor

An examination revealed the nares and ears to be essentially negative. The submaxillary glands were moderately enlarged bilaterally. Moderate-sized infected tonsils were present.

A mass, mulberry in color, was seen involving the right lateral pharyngeal band extending from the upper third of the tonsil to a centimeter below the Eustachian orifice. It measured approximately 6 mm. in width and 5 mm. in height. Through the tightly stretched mucous membrane covering the growth several blood vessels and capillaries were seen. These had the appearance of venous channels. The nasopharynx including the Eustachian orifices and posterior nares was negative. A Roentgen examination of the sinuses revealed no clouding. The cervical sympathetic was evidently not involved as there was no evidence of Horner's syndrome. A general physical examination including serology was negative. A diagnosis of hemangioma was made.

In determining the type of anesthesia to use for the operation we decided to avoid infiltrating around the mass as inadvertently the needle might penetrate the growth and cause hemorrhage; consequently the surgery was performed by using only topical cocaine anesthetic which proved satisfactory.

With instruments for ligating the external jugular at hand if needed the soft palate was retracted, thereby rendering visible the entire tumor

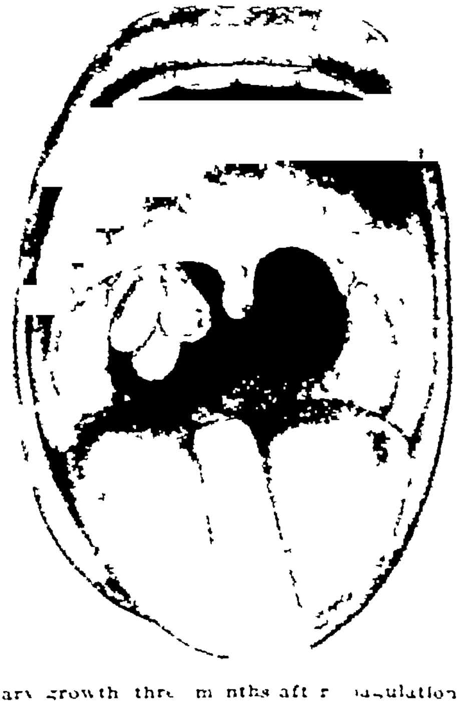


Fig. 2. Secondary growth three months after coagulation of the primary mass.

The whole mass was electrocoagulated, as well as 2 or 3 mm of what appeared to be normal tissue immediately surrounding the growth No bleeding occurred during the surgical procedure or during convalescence

In three weeks the patient was dismissed as cured having made an uneventful recovery

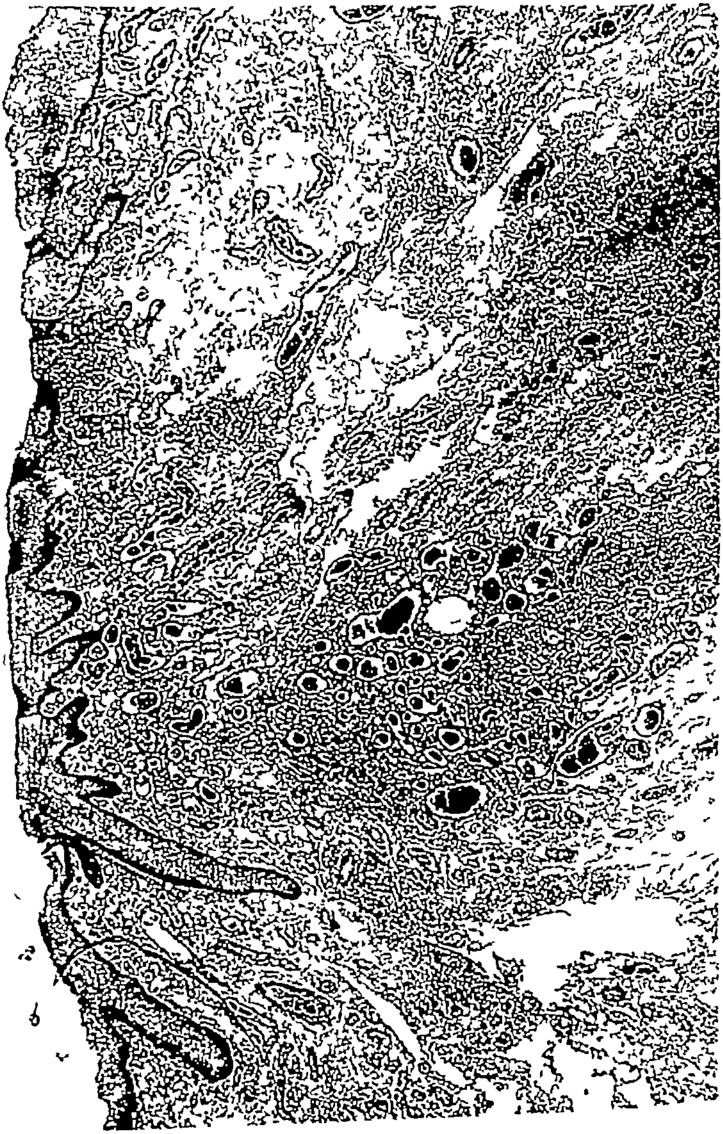


Fig 3 Photomicrograph of the secondary growth (low power)

Three months later the patient returned with a pedunculated tumor which had three lobules approximately in the same location as the first tumor It was creamy white in color and friable upon palpation

The entire mass was irregularly rounded and about 1 5 cm in diameter It was attached above the level of the soft palate and hung downward into the oropharynx

Under general anesthesia we attempted to dissect the pedicle from its attachment, but as each lobule was grasped for traction it became detached from the pedicle Finally only the pedicle remained This we dissected from its base on the lateral pharyngeal fold We then touched the raw area with trichloracetic acid Little bleeding ensued A tonsillectomy was also performed at this time

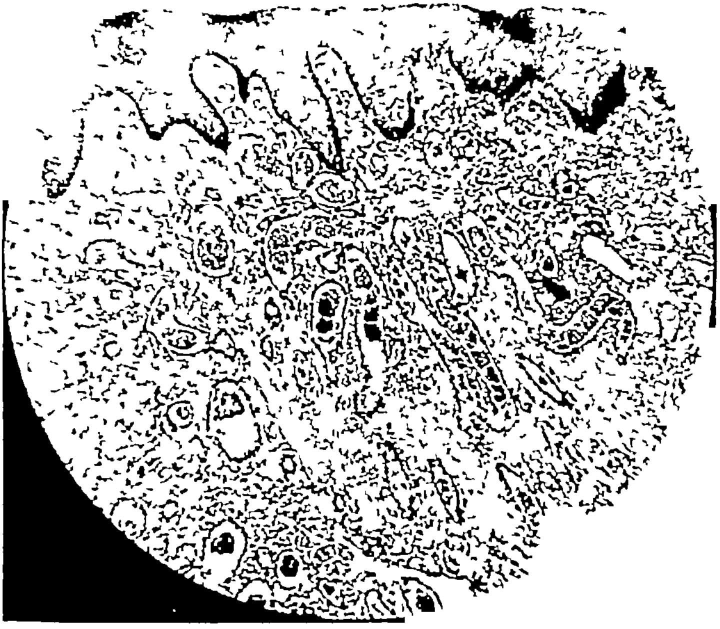


Fig 4 Photomicrograph of the secondary growth (high power)

The report of the pathologist on the tissue removed at the second operation is as follows The tissues show a covering of stratified squamous epithelium of varying thickness ulcerated in some areas and diffusely infiltrated with polymorphonuclear leucocytes Dermal papillae and deeper connective tissues for a depth of 3 to 4 mm are filled with vascular channels of varying size Those channels are dilated lined by endothelium and filled with red cells The stroma of this vascular lesion is the site of many neutrophiles and the inflammatory reaction is most intense at the periphery of the section Round cells and histiocytes are present but are not nearly so numerous as are polymorphonuclear cells

"*Diagnosis* Hemangioma of pharynx with acute and chronic inflammatory changes presumably secondary to ulceration of the pharyngeal mucous membrane"

CONCLUSIONS

1 The angioma type of tumors rarely occur on the lateral pharyngeal fold

2 A surgeon should be prepared to cope with an extensive hemorrhage when removing these as well as other new growths of the pharynx

3 These masses at times retrogress after only a portion of the tumor is removed, however, in this case all of the visible tumor was removed, yet it recurred in a totally different form

4 After two years the patient has had no further reocurrence

BIBLIOGRAPHY

1 Lichtwitz, L. Ein Fall von Angiom des Pharynx *Monatsschr f Ohrenh.*, 29 330, Sept, 1895

2 Lillie, H I, and Heck, W E Hemangioma of the Lateral Pharyngeal Band *Ann Otol, Rh nol and Laryngol*, 57 519, June, 1948

3 Milligan, W Nasopharyngeal Growths *Jour Laryngol and Otol*, 39 537 544, 1924

4 Rosenberger, H C Tumors of the Nasopharynx Clinical Congress American College Surgeons, Oct 18, 1948

5 Woodward, J F, Jr Cavernous Hemangioma of the Hard and Soft Palate, Anterior and Posterior Pillars of the Pharynx and the Larynx The Laryngoscope, 46 32-41, Jan, 1936

Bennie Dillon Building

SOLITARY NEUROFIBROMA OF THE LARYNX (REPORT OF TWO CASES)

GILBERT E. FISHER, M.D., and JOHN S. ODESS, M.D.,
Birmingham, Ala.

Although solitary benign tumors arising from peripheral nerves and possessing the characteristic picture of neurofibromata are seen frequently in almost all parts of the body, their occurrence in the larynx is extremely rare. Indeed, it is so rare that our review of the world's literature on the subject reveals only 19 such cases, nine being reported by foreign investigators and 10 reported in the American literature. The first case reported was by the German, Suchanek[1], in 1925. Jackson and Coates[3] reported the first case in the American literature in 1929. Smith[13] reported three cases in 1944, which is the largest number of cases presented by one author. New and Erich[5] found only one case in their review of 722 benign tumors of the larynx seen at the Mayo Clinic in a 30-year period ending in 1938. At the Medical College of Alabama we have seen two cases of solitary neurofibroma of the larynx since 1943.

CLINICAL CONSIDERATION

The symptom complex presented by patients with solitary neurofibroma of the larynx is that generally found in all noncancerous tumors of this organ. Depending upon the size, position and location of the growth, symptoms vary from mild hoarseness to distressing dyspnea.

The majority of the patients reported were in the third decade of life, however, one patient reported was 60 years of age (Case 1) and the youngest was four.[12] The disease is more frequent in females than in males.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication Sept. 24, 1949.

CASES REPORTED THUS FAR IN LITERATURE

Author	No of Cases	Date	American or Foreign
Suchanek[1]	1	1925	Foreign
Holmgren and Bergstrand[2]	1	1928	Foreign
Jackson and Coates[3]	1	1929	American
Claus[4]	1	1930	Foreign
Vail[5]	1	1933	American
Gignoux[6]	1	1936	Foreign
Malan[7]*	2	1937	Foreign
New and Erich[8]	1	1938	American
Hoover[9]	1	1940	American
Seidel[10]	1	1940	Foreign
Baldenweck and Leroux[11]	1	1942	Foreign
Van Loon and Diamond[12]†	2	1942	American
Thomas Smith[13]	3	1944	American
New and Devine[14]	1	1947	American
Oliver, Diab and Abu Jaudeh[15]	1	1948	Foreign

*One of the cases reported by Malan was previously diagnosed and reported by Morshik

†One of these cases was reported by Tucker in a personal communication to the authors

The tumor may appear in any portion of the larynx but has been found most commonly in the region of the aryepiglottic fold Its usual appearance is that of a smooth, rounded, solid, yellowish encapsulated growth If the tumor is small it may be removed by large cupped biting forceps, as was experienced in our two cases As the growth enlarges and is discovered at a later stage in its development it may be necessary to remove it by laryngofissure The largest tumor of this type, reported by Vail,[5] was 3¼ x 2½ x 1½ cm The exact diagnosis, of course, is established by microscopic examination of the tissue removed

PATHOLOGIC ANATOMY

Histologically, these tumors are characteristically neurofibromata The great confusion in terminology, such as "neurinoma, "Schwannoma," "peripheral neurofibroma," "peripheral fibroblastoma," "perineural fibroblastoma," etc, has arisen because of the highly controversial theories as to the specific tissue from which tumors of this type have their origin and the tendency of the different pathologists to name the tumor observed after the supposed tissue of origin

Smith[13] states, "These characteristics are best synopsized by Ewing's concise description He stated that the tumor is covered by a distinct capsule which he thought was distended epineurium He described the growth as being made up of two kinds of tissue, the main tissue being fasciculated, with elongated cells and fibre bands arranged in a palisade manner, and the remaining tissue being reticulated with few fibres, irregularly scattered cells and much intercellular fluid lying in vacuoles or forming small cysts containing mucinous material The blood vessels in this tissue show characteristic hyaline thickening" Smith[13] further states, "These single noncancerous tumors, designated by so many different terms, are usually quite firm and well encapsulated, and have no tendency to undergo cancerous degeneration They tend only to destroy by direct pressure, and as their growth is usually slow and characterized by frequent arrests, their effect on the larynx is principally that of obstruction If the growth is entirely removed, there is no tendency toward recurrence"

CASE REPORT

Case 1 J W L. bookkeeper age 75, white male was apparently in good health until January, 1928 when he noticed the insidious onset of progressive dyspnea slight nonproductive cough and a feeling of a lump in his throat that he localized by pointing to the level of the cricoid cartilage These symptoms became progressively worse until 1938 when in addition he became hoarse There was no dysphagia hemoptysis etc He was so dyspneic he could hardly walk 20 feet without resting He consulted a physician and in the course of the next five years had three direct laryngoscopies with removal of some tissue on each occasion

Upon our first examination April 28 1943 the patient appeared extremely dyspneic Routine ear nose and throat examination was negative except for the larynx The patient was hoarse and external examination of the larynx revealed it to be freely movable and there were no remarkable nodes in the neck Mirror examination of the larynx revealed the epiglottis to be normal The aryepiglottic folds were slightly injected and the false cords edematous There was some limitation of motion of the left cord and on the upper surface of the base of the left cord there was a pedunculated small yellow nodular mass about the size of a small pea impinging upon the glottic chink The larynx was normal otherwise

On Sept. 8 1943 a direct laryngoscopy was done and the mass was completely removed with cup-type laryngeal forceps including a small part of the true cord Since operation the patient has done well His last visit was Jan 6 1949 and examination revealed no recurrence

PATHOLOGICAL REPORT

Microscopic Description Section through specimen shows the bulk of the small mulberry like masses to be made up of dense, old, hyalinized connected tissue connected by stratified cuboidal epithelium In some areas this epithelium appears to have cilia After examination of Zenker's sections the presence of vacuolated macrophages plus the fact that there is a distinct tendency of the nuclei to palisade, inclines one to believe that this represents neurofibroma of the vocal cord

CASE REPORT

Case 2 H H, filling station operator, age 23, white male, was first seen by us July 1, 1948, complaining of hoarseness and dry cough of one month's duration There was no dyspnea, dysphagia pain hemoptysis, etc Routine ear nose and throat examination was negative except for the larynx, which showed injection of both cords, worse on the left, and a small yellowish growth on the left aryepiglottic fold adjacent to the left arytenoid

On the same afternoon the patient was laryngoscoped under local anesthesia and the mass from the left aryepitglottic fold removed *in toto* with laryngeal cup forceps The postoperative course was uneventful and when last seen on Jan 6, 1949 the patient was doing well without recurrence

PATHOLOGICAL REPORT

Gross Description The specimen consists of a firm, grayish white mass irregular in shape, measuring 7 mm long and 3 mm in diameter

Microscopic Examination The section through the specimen shows a surface of stratified squamous epithelium beneath which there is a peculiar plexiform structure made of bundles of fusiform cellular elements with elongated, wavy nuclei and very delicate pink staining fibrils In general these are parallel in their arrangement, but in some places there seems to be a tangential direction to some of the fibrils In other areas they are in cross direction and with phosphotungstic acid hematoxylin stain the structure is brought out even more prominently than previously noted Many of the fibrils are blue and are apparently of nervous origin, but many were also brownish and raised the question as to whether these cells are arising from the sheath of Swann There is no variation in nuclear size, mitoses are practically absent

BIBLIOGRAPHY

1 SUCHANEK Neurinoma des Kehlkopfeinganges *Monatsschr f Ohrenh*, 50 613, 1925

2 HOLMGREN G and BERGSTRAND, H Neurinoma Case Report *Acta Oto Laryngol*, 12 514, 1928

3 JACKSON, C and COATES G M The Nose Throat and Ear and Their Diseases Philadelphia W B Saunders Co, 1928

4 CLAUS Demonstration d'une Preparation d'un Neurinoma de Larynx *Soc O, R, L du Berlin*, 5 Cance du 17 1 30

TRANSITIONAL CELL CARCINOMA OF THE NASOPHARYNX IN A CHILD

BRUCE F GROTTS, M D ,
Wilmette, Ill

A transitional cell carcinoma of the nasopharynx in a two-year-old child is an unusual tumor Among 2,000 cases of neoplasia seen at the University of Michigan from 1895 to 1913, no case of carcinoma of the nasopharynx in a very young child is recorded,[1] and Pack and LeFevre[2] found only two nasopharyngeal epitheliomas from birth to four years of age out of a series of 16,565 malignant tumors seen at the Memorial Hospital in New York City Friedman and Rubenfeld[3] also, in a smaller series of 3,161 neoplasms seen at Bellevue Hospital from 1925 to 1932, found only four carcinomas in children between one and five years of age None, however, was located in the nasopharynx Of the three tumors located in that region, the youngest patient was 16 years of age

Besides being a rare type of tumor, its occurrence is unusual in the birth to five years of age group Dargeon[4] reported seven cases of nasopharyngeal carcinoma from 1930 to 1937, the average age being seven years The youngest patient he reported was four years old New and Childrey[5] also found their youngest case to be four years old, in a series of 74 cases of malignancy of the palate and pharynx collected during the years 1917 to 1930 New and Hertz[6] state that the youngest patient they have seen was a three-year-old boy with a Grade IV squamous cell epithelioma who died within two months after the onset of symptoms

The latter patient and the one reported in this paper appear to be among the youngest cases on record

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication April 15 1949

CASE REPORT

C W , a 29 months old child, entered the Milwaukee Children's Hospital on Dec 15, 1948 Five weeks before admission, she had been taken to another hospital with a sore throat and a draining ear Her breath was noted to have a foul odor at that time A "retrophayngeal abscess' was diagnosed and drained surgically, and a growth of "granulation tissue" was noted in the pharynx, but no biopsy was taken She was given three weeks of penicillin therapy but did not improve and lost weight, so was taken home She was kept at home for two weeks and then admitted to the Milwaukee Children's Hospital with the complaints of poor appetite and weight loss The right eye had become "crossed" one week prior to admission and the foul breath had returned although the ear no longer drained

Her birth and developmental histories were normal, and the family history was noncontributory

On examination, the child appeared acutely ill, dehydrated and weak. She held her mouth open constantly, and her breath was very foul Palpation of the skin showed little subcutaneous fat and loss of normal turgor There were several large cervical nodes on the left which were matted and tender, and she resisted anterior flexion of the neck because of pain Examination of the eyes revealed a right internal strabismus but no pupillary changes

The posterior nares were completely obstructed with thick mucus, and she, therefore, breathed through her mouth The soft palate was pushed downward and forward by a rather firm mass which protruded into view posteriorly, and appeared dark brown, crusted and necrotic It seemed a little fluctuant on the right to manual examination. There was marked surrounding edema and cellulitis with obstruction to nasal respiration

The remainder of the examination and neurological was normal The admission impression was a retropharyngeal abscess, but foreign body and neoplasm were to be ruled out.

Her fever on admission was 103° F , and the smear and culture of the nasopharynx revealed pus cells, staphylococci and H influenzae, but no C diphtheriae She was, therefore, placed on parenteral penicillin and streptomycin and the dehydration was corrected by subcutaneous fluids X ray examination on the day after admission revealed normal sinuses. Lateral views, however, showed widening of the retropharyngeal and retronasal spaces The retrolaryngeal space was normal No air was noted in the posterior nasal passages, and there was no sign of pathology in the cervical spine

After several days of therapy, the edema and cellulitis began to subside and another manual examination revealed only swollen, boggy, friable tissues in the nasopharynx, but no foreign body A catheter could be passed completely through the right nostril into the posterior pharynx, but it met obstruction in the left nasopharynx.

After eight days of parenteral antibiotic therapy, the fever became normal, but there was only slight improvement in the breathing and obstructive signs On the fifteenth hospital day the right pupil appeared dilated and reacted sluggishly to light. There was a ptosis of the right upper lid Fundus examination showed no papilledema but did demon strate dilated tortuous veins The postnasal swelling seemed smaller and the palatal cellulitis was less marked On manual examination at this time a mass the size of a cherry could be felt on the left side of the nasopharynx in the region of the fossa of Rosenmuller

Puncture incisions through both sides of the soft palate and into this tumor were performed on the fifteenth hospital day after it was believed that the maximum benefit had been obtained from medical therapy and secondary infection had been controlled Incisions were also made into the posterior wall of the pharynx on both sides but no pus was obtained Re-X ray after this procedure revealed the nasopharynx still occluded but less swelling was present retropharyngeally No bone erosion was noted at the base of the skull but a repeat X ray four days later suggested a questionable erosion of the anterior arch of the first cervical segment

As no pus was obtained from the multiple incisions a biopsy of the tumor mass behind the soft palate was done The specimen consisted of a soft yellow piece of tumor tissue 1 cm by 0 6 cm by 0 4 cm It was irregular and partially necrotic

On microscopic examination the tumor was made up of undifferentiated cells irregular in size and shape and arranged in very poorly formed acini The nuclei were extremely hyperchromatic and occupied almost all of each cell Mitotic figures were infrequent and appeared somewhat irregular Many dead cells were present and a large amount of fragmented nuclear material could be seen throughout the sections The superficial part of the tumor was entirely necrotic A Gram stain revealed many monilia spores and mycelia in this superficial necrotic tissue Dr Gorton Ritchie s diagnosis was a transitional cell carcinoma of the pharynx.

Following this diagnosis 11 deep X ray treatments of 210 r each were given to both the left and the right nasopharynx This therapy was completed on Jan 19 1949 and she was then discharged home to be followed as an out patient She did not return to the hospital however and died at home on Jan 24 1949 10 weeks after the onset of symptoms

No necrospy was obtained

Laboratory The urine examination on admission was positive for acetone diacetic acid and albumin Microscopically there were occasional R. B C and 15 W B C The blood count on admission revealed 5 800 W B C per cm with 69 per cent leucocytes There were 12 gm of hemoglobin per 100 cc and the sedimentation rate was 30 mm in one hour During the course of hospitalization the hemoglobin fell and a transfusion of 200 cc of whole blood was given After this transfusion the blood count showed 4 750 W B C per cm with 39 per cent leucocytes and 15 gm of hemoglobin per 100 cc The blood culture on admission revealed no growth and the Kline test was negative

COMMENTS

Next to the retinal glioma, the most common location of cancer of the head and neck in children is in the region of the nasopharynx, tonsil and soft palate[4] "Ordinarily the tumor is a single, sessile, firm, circumscribed and movable growth with a smooth, nonulcerated surface"[5] The size commonly varies from 1 to 14 cm[5] In this case the tumor was about 1 or 2 cm in diameter, but it was the surrounding reaction and secondary infection that caused many of the obstructing nasopharyngeal signs

Such tumors may extend into the nasopharynx, obstruct the choanae and Eustachian tube, push the palate forward and partially fill the mouth[5] Occasionally they may erode the cervical vertebrae, as was apparently occurring in this patient Usually, the transitional cell-type tumor is not bulky but, due to its peculiar location, it may present nasal or nasopharyngeal obstruction and/or earache According to Dargeon,[4] "Nasal obstruction which comes on after two years should not be ascribed to adenoids"

The lymphoepithelium as found over the tonsils, vault of the pharynx and nasal passages presents histological and clinical peculiarities, and tumors of the nasopharynx, therefore, are often very anaplastic and highly malignant lymphoepitheliomas or transitional cell carcinomas, Grade III or IV[4,7]

Often persistent cervical adenopathy is the first sign noted, and extensive metastases may occur before the local lesion is found[3] In any case, therefore, with persistent asymmetrical cervical adenopathy, neoplasia should be considered and adequate search for the primary lesion in the upper respiratory tract should be made[4,8]

Mortality due to carcinoma in childhood is extremely high, and most cases of carcinoma of the nasopharynx terminate in death in from two months to three years[9] For example, the average duration of life from the first symptoms to the time of death was 20 months in Dargeon's[4] series of seven cases A short course of only 10 weeks was present in our case

Figi,[9] however, is one of the few authors who has reported a squamous cell carcinoma of the nasopharynx in an 11-year-old boy which apparently responded to radium therapy, however, even if the tumor is apparently controlled locally, generalized metastases often occur, and death results Often these nasopharyngeal tumors are highly radiosensitive, but are usually not locally accessible to surgery[4]

Rector,[10] in discussing carcinoma in young persons, states that in Michigan, from 1938 to 1942, there were 546 deaths due to carcinoma in persons under 20 years of age "None of the communicable diseases, measles, smallpox, scarlet fever, pertussis or rheumatic fever come close to causing the number of deaths in Michigan each year that carcinoma does"[10] Judging from these figures, it appears that carcinoma in childhood is a relatively important cause of death, and the mortality rate is extremely high[5] Statistical improvement may occur when earlier recognition of the disease permits therapeutic measures to be initiated more promptly[5] Such an early diagnosis is often delayed, as the age of the patient is commonly a misleading factor If the not unusual occurrence of neoplasia in children is kept in mind, however, and microscopic examination of suspicious tissue is undertaken earlier, it is hoped these disappointing statistics may be greatly improved

SUMMARY

1 A transitional cell carcinoma of the nasopharynx in a two-year-old child is an unusual tumor The record of such a case is reported

2 Carcinoma of the nasopharynx may be found only after a persistent, asymmetric, asymptomatic cervical adenopathy is biopsied

3 Suspicious, refractory tumor masses in the nasopharynx, with or without obstructive symptoms, earache, or persistent foul drainage, should be biopsied promptly as they may be malignant

4 Transitional cell carcinoma may be highly malignant, but is often very radiosensitive

5 The mortality of carcinoma in children is extremely high and is a relatively important cause of death

It is hoped that earlier biopsy, diagnosis and treatment will improve these statistics

---

I thank Dr H Miner for his cooperation in presenting this case

BIBLIOGRAPHY

1 Warthin, A *Arch Int Med*, 15 444, 1915

2 Pack, G, and LeFevre, R *Jour Cancer Research*, 14 167, 1930

3 Friedman, M, and Rubenfeld, S *Amer Jour Cancer* 22 786, Nov, 1934

4 Dargeon, H Cancer in Childhood St Louis C V Mosby Co 1940

5 New, G, and Childrey, J *Arch Otolaryngol*, 14 699 1931

6 New, G, and Hertz, C *Surg Gynec and Obst*, 70 163 Feb 1940

7 Ewing Neoplastic Diseases Philadelphia and London W B Saunders Co

8 Dargeon, H *Jour Pediat*, 15 317, Sept 1939

9 Figi, F *Ann Otol, Rhinol and Laryngol* 50 1218 Dec, 1941

10 Morehead, R *Arch Pathol*, 38 141, Sept, 1944

NEW METHOD OF THREADING AN ESOPHAGEAL STRICTURE

HENRY J RUBIN, M D ,
Los Angeles, Calif

Passage of a string through the esophagus is sometimes imperative to forestall gastrostomy Occasionally this preliminary step in treatment is most difficult, and it may be impossible

The following method was devised under a peculiar set of circumstances A female infant was born with a stenosis, approximately 2 5 cm long, in the thoracic esophagus Esophagoscopy revealed an abrupt narrowing of the esophagus in the midthoracic region to a small, centrally situated orifice about 3 mm in diameter A No 10 bougie passed through tightly Very slow feeding with dilute formula was possible, and the father, a physician, refused to permit gastrostomy for institution of retrograde dilatation as long as the child maintained itself The suggestion of occasional esophagoscopies with bougie dilatation was likewise rejected The infant swallowed a weighted string readily, but it coiled proximally to the stenosis and was repeatedly vomited up after 24 to 36 hours An attempt to pass a small stringed lead shot on a positor through an esophagoscope was abandoned, after one attempt, as unsafe When the child was seven months old, the father insisted that something be done to facilitate feeding and permit the addition of solid foods

The following successful method of passing a string was devised a small piece of lead foil was pounded to less than half millimeter thickness, shaped around a needle, and cut to

---

Editor's Note This ms received in Laryngoscope Office and accepted for publication Oct 27 1949

one-quarter inch length No 3 linen "cord," which is thinner than ordinary string but much stronger, was threaded through the small lead cylinder, and the metal was gently hammered

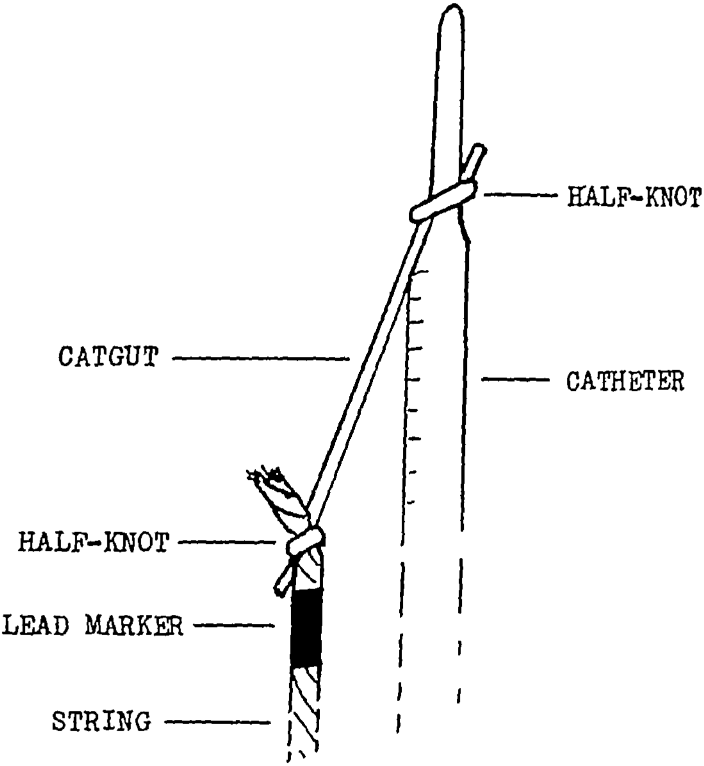


Fig 1 Combined diameter of catheter and string is 3 mm

until the malleable lead partially shredded the string and became so enmeshed in it as to be incapable of separation without the exertion of undue force This was done to permit following the position of the string by fluoroscopy The distal end of the string was cut so that only one-quarter inch protruded beyond the lead marker With hemostats, a small piece of No 000 catgut was tied tightly to this end of the string with only the first loop of a square knot, and the other end was tied in the same manner to the tip of a No 6 woven ureteral catheter This catheter is sufficiently firm to be guided into and through the esophagus but buckles easily and is incapable of perforating the esophagus The piece of catgut was an inch long and connected the catheter and string with temporary security The half-tied catgut knots were cut short

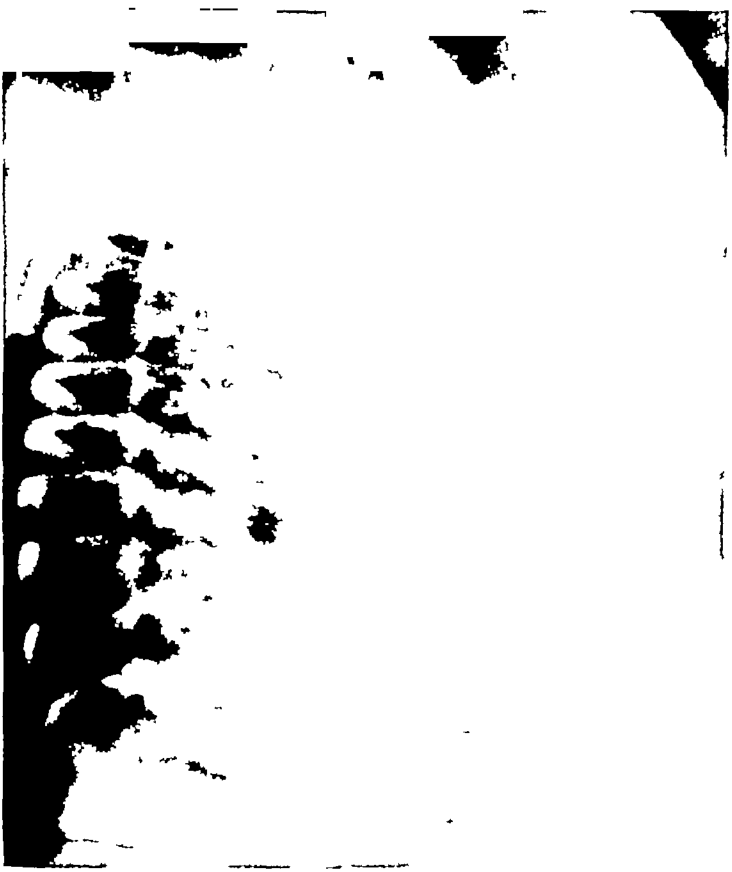


Fig 2 Appearance of stricture through which string was passed

Under fluoroscopic guidance, without anesthesia, and with suction for repeated pharyngeal aspiration, the catheter was passed into the esophagus It came to an abrupt stop at the level of the stenosis, and manipulation was begun to find the opening After about five minutes of gentle pressure and twisting, it suddenly slipped through, and the lead marker was seen to enter the stomach Further manipulation, turning and contact with stomach secretions served to loosen one of the half-tied knots, and within 10 minutes the catheter had slipped free and was withdrawn, leaving the string in the stomach That the catheter actually lay free was easily determined, for the lead marker on the string no longer moved up toward the stricture as the catheter was started out The course of the marker was then followed for several days as it moved through the intestinal tract When the string had passed per rectum, dilatation with perforated metal olive-tipped bougies was begun and has continued successfully as an office procedure

This method is suitable where a guide string in the esophagus is desired but cannot be passed, and gastrostomy is the alternative

3875 Wilshire Boulevard

THE RESEARCH STUDY CLUB

The Nineteenth Annual Midwinter Postgraduate Clinical Convention in Ophthalmology and Otolaryngology will be held in Los Angeles, Jan 15 to 27, inclusive Given by the Research Study Club of Los Angeles, this event has come to be regarded as one of the outstanding meetings of the two specialties each year

The featured speakers include Dr Conrad Berens, Director of the Ophthalmological Foundation of New York and Chief of the New York Eye and Ear Infirmary, and his associate, Dr Raymond E Meek The principal otolaryngologists will be Dr Percy E Ireland, Professor of Otolaryngology at the University of Toronto, and his assistant professor, Dr Joseph A Sullivan

Special lectures of interest to otolaryngologists will be given by Dr George C Griffith and Dr Samual L Perzig, of the University of Southern California School of Medicine, Dr Rea E Ashley, of Stanford School of Medicine, J C Harding, D D S, of San Diego, "Nutrition for the Specialist," and Dr Cecil H Collins, of the University of Southern California College of Dentistry

A special course in "Surgery of the Eye" will be given by Dr Meyer Weiner, in which the various operations for correction of ptosis and epicanthus, along with sliding grafts for the reconstruction of the upper and lower lids, will be discussed Other outstanding ophthalmologists on the program are Phillips Thygeson, M D, who will give The Third Doheny Lecture, Frederick C Cordes, M D, Professor of Ophthalmology of the University of California School of Medicine, and Archie E Cruthirds, M D, of Phoenix, Ariz

Each applicant must be a member of his own local medical society in order to become eligible for attendance at the course The fee (Clinical Course, $75 00, Special Course in Surgery of the Eye, $50 00) should be sent to Pierre Viole, M D, Treasurer, 1930 Wilshire Boulevard, Los Angeles, Calif

BOOK REVIEWS

Recent Advances in Otolaryngology Second Edition by R Scott Stevenson, M D, Ch B F R C S, Surgeon Metropolitan Ear, Nose and Throat Hospital, President Section on Otology, Royal Society of Medicine 106 text figures, eight plates, 395 pages, 1949 Philadelphia The Blakiston Co Price $6 00

This is an excellent book, which, as the author states in his preface, is somewhere between a textbook and a year book All the more recent work in otolaryngology is reported, with comments that are worthwhile

There is an excellent bibliography at the end of each chapter and the illustrations borrowed from many sources are well reproduced

The book is invaluable because it will bring the readers up to date in the newer work in the field and is delightful reading withal

T E W

Audiology The Science of Hearing A Developing Professional Specialty By Norton Canfield, M D Associate Professor of Otolaryngology Yale University School of Medicine Board of Directors, Audiology Foundation, Board of Directors, American Hearing Society, Vice President International Audiology Conference, Consultant in Audiology Veterans Administration Consultant in Otolaryngology, Office of the Surgeon General, Department of the Army, Washington, D C With Foreword by Gunnar Holmgren, Professor of Otolaryngology Stockholm, Sweden Publication No 51, American Lecture Series 44 pages with bibliography Springfield Ill Charles C Thomas, Publishers, 1949 Price $1 75

This very short text 38 pages, might be of help to the layman who wants to know what "audiology" means It might be used as a starting point for interesting a civic minded individual in raising funds for a hearing center We wonder what other purpose the author had in mind when he wrote it.

T E W

Acute Laryngotracheobronchitis By A Harry Neffson M D 197 pages with index New York (16) N Y Grune & Stratton Inc 1949 Price $5 00

This is an excellent book by an author whose vast experience qualifies him to write authoritatively The whole subject of laryngotracheobronchitis is excellently and completely covered

One may suppose that many will disagree with Dr Neffson s enthusiasm for intubation, however he states clearly the indications and contraindications for this procedure and emphasizes the need for expertness if intubation is to be contemplated

The chapter on Tension Pneumothorax and Mediastinal Emphysema is very valuable and emphasizes a complication all too frequently undiagnosed

The chapter on Treatment is very complete and is presented beautifully clearly and concisely Every phase is thoroughly covered

This book should be a standard text in children s hospitals in hospitals for infectious diseases and in postgraduate courses in otolaryngology

T E W

Clinical Audiology By Maurice Saltzman M D Assistant Professor of Otorhinology Temple University School of Medicine Associate Otolaryngologist Mount Sinai Hospital Philadelphia Diplomate American Board of Otolaryngology Introduction by George M Coates M D Chief Editor Archives of Otolaryngology and Professor of Otolaryngology Emeritus University of Pennsylvania Foreword by Matthew S Ersner M D Professor and Head of the Department of Otorhinology and Rhinoplasty Temple University School of Medicine 195 pages with index and 82 illustrations New York (16) N Y Grune & Stratton Inc 381 Fourth Avenue 1949

This book supposedly the latest word on Clinical Audiology is a great disappointment. It is full of statements that lack proof for instance on page 25 A sclerotic mastoid is a better conductor of sound than cancellous bone Page 49 Most often however it is the vascular twigs to the cochlea that have become involved in the arteriosclerotic process and as no collateral circulation is present in the basal turn the sclerosing end of the arteriole must of necessity be followed by secondary nerve degeneration and a greater high frequency loss will be shown on the audiogram Page 73 Tinnitus aurium is a constant symptom of otosclerosis in the adult. Page 74 In the prophylaxis and treatment of otosclerosis dietary regulation and the administration of calcium liver extract insulin and vitamins are of considerable value according to Guggenheim '

From reading the chapter on Ménière s Syndrome and Symptomatic Ménière s Syndrome one might assume that the diagnosis and treatment are simple As the etiology becomes evident the therapeutic indications are clear-cut and the prognosis is predictable O that this were true'

It seems a pity that the author has not caught up with the latest available literature his bibliography is most inadequate

There are many audiograms most of which could well have been omitted and the chapters on Hearing Tests and Hearing Aids are deplorably inadequate He hardly seems aware of the value of speech testing or how it is done There seems to be little excuse for this publication

T E W

New Gould Medical Dictionary A modern, comprehensive dictionary of terms used in all branches of medicine and allied sciences, including medical physics and chemistry, dentistry, pharmacy, nursing, veterinary medicine, biology and botany, as well as medicolegal terms, with illustrations and tables Edited by Harold Wellington Jones M D , Normand L Hoerr, M D , Arthur Osol, Ph D , with the cooperation of an editorial board and 80 contributors Two hundred fifty two illustrations on 45 plates, 129 in color First edition Philadelphia The Blakiston Co 1949

This dictionary is comprised of a volume of material for which every field of medicine is represented in an up to date manner Not only does the selection of material show clear straight forward presentation but worthless entries which have cluttered previous dictionaries have been omitted The pronunciation of words is indicated in simple form and the standard for correctness is clearly shown Proper names attached to structures or discoveries are usually to be found under a short biographical sketch All tables are included in a section of their own at the back of the book instead of being scattered through it The illustrations are likewise included in a single section, but near the center of the book They represent 45 plates of well selected and clearly reproduced figures for which references appear throughout the text. The type selected and the arrangement is an aid to the ease and amount of time used in finding a particular term

This dictionary is one which will be most acceptable to all concerned with any aspect of medicine

W P C

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION

As of December 1, 1949

Aurex (Semi-Portable), Aurex Model C-B, Model C-A, Model F and Model H

Manufacturer Aurex Corp 1117 N Franklin St. Chicago Ill

Beltone Mono-Pac, Beltone Harmony Mono-Pac, Beltone Symphonette

Manufacturer Beltone Hearing Aid Co, 1450 W 19th St Chicago Ill

Dysonic Model 1

Manufacturer Dynamic Hearing Aids, 43 Exchange Pl, New York 5, N Y

Electroear Model C

Manufacturer American Earphone Co, Inc. 10 East 43rd St. New York 17, N Y

Gem Hearing Aid Model V-35

Manufacturer Gem Ear Phone Co, Inc 50 W 29th St. New York 1, N Y

Maico Type K, Maico Atomeer

Manufacturer Maico Co Inc North Third St. Minneapolis Minn

Mears Aurophone Model 200, 1947—Mears Aurophone Model 98

Manufacturer Mears Radio Hearing Device Corp 1 W 34th St New York, N Y

Micronic Model 101 (Magnetic Receiver), Micronic Model 303

Manufacturer Micronic Co 727 Atlantic Ave, Boston 11 Mass

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES

AMERICAN OTOLOGICAL SOCIETY

President Dr Philip E Meltzer, 20 Charlesgate, West Boston 15, Mass
Secretary Dr Gordon D Hoople, Medical Arts Bldg, Syracuse 3 N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Ralph A Fenton, 906 Medical Arts Bldg, Portland, Ore
Secretary Louis H Clerf, 1530 Locust St Philadelphia 2 Pa
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

President Dr Robert C Martin, 384 Post St., San Francisco 8, Calif.
Secretary Dr C Stewart Nash, 708 Medical Arts Building, Rochester, N Y
Meeting Mark Hopkins Hotel, San Francisco, Calif, May, 1950

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC

Eastern Section, Hotel Statler, New York, N Y, Jan 5, 1950
Council Meeting, Hotel Statler, New York City, Jan 6 1950
Combined Meeting, Southern and Middle Sections, Peabody Hotel Memphis, Tenn, Jan 16-17, 1950
Western Section, Medical Society Bulding, Los Angeles, Calif, Jan 21 22, 1950

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Fletcher D Woodward, 104 E Market St., Charlottesville, Va
Secretary Dr James M Robb, 641 David Whitney Bldg, Detroit Mich

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr J Mackenzie Brown, 1136 W 6th St, Los Angeles, Calif
President Elect
Executive Secretary Dr William L Benedict, Mayo Clinic, Rochester Minn
Meeting Palmer House, Chicago Ill, Oct 9 14, 1949

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President Dr George E Shambaugh Jr 55 E Washington St Chicago, Ill

President Elect Dr Wm H Evans 24 Wick Ave Youngstown Ohio

Secretary Treasurer Dr Joseph Hampsey 806 May Bldg Pittsburgh 22 Pa

PAN AMERICAN ASSOCIATION OF OTO RHINO-LARYNGOLOGY AND BRONCHO ESOPHAGOLOGY

President Prof Justo Alonso

Secretary Dr Chevalier L Jackson, 255 S 17th St Philadelphia Pa

Second Pan American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology Montevideo January 1950

AMERICAN BRONCHO ESOPHAGOLOGICAL ASSOCIATION

President Dr LeRoy A Schall, 243 Charles St Boston Mass

Secretary Dr Edwin N Broyles, 1100 N Charles St Baltimore 1 Md

Meeting Mark Hopkins Hotel, San Francisco Calif, May, 1950

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Warren A. Wilson.

Secretary Treasurer Dr Victor Goodhill

Chairman of Section on Ophthalmology Dr George Landegger

Secretary of Section on Ophthalmology Dr Harold B Alexander

Chairman of Section on Otolaryngology Dr Alden H. Miller

Secretary of Section on Otolaryngology Dr Leland R. House

Place Los Angeles County Medical Association Bldg, 1925 Wilshire Blvd, Los Angeles, Calif

Time 6 P.M fourth Monday of each month from September to May inclusive

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY

President Dr Alfred Schattner 115 E 61st Street New York 21 N Y

Secretary Dr Norman N Smith 291 Whitney Avenue New Haven 11 Conn.

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr Garnett P Morison Charles Town W V

First Vice-President Dr Charles T St. Clair Jr Bluefield W Va.

Second Vice-President Dr Arthur C Chandler Charleston W Va

Secretary Dr Melvin W McGehee 425 Eleventh St. Huntington 1 W Va

Treasurer Dr Frederick C Reel Charleston W Va.

Directors Dr Eugene C Hartman Parkersburg W Va. Dr Ivan Fawcett Wheeling W Va

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Alston Callahan, 908 S 20th St, Birmingham, Ala
Chairman Elect Dr Francis LeJeune, Ochsner Clinic, New Orleans, La
Vice Chairman Dr Edwin Broyles, 1100 N Charles St, Baltimore, Md
Secretary Dr Edley H Jones, 1301 Washington St, Vicksburg, Miss

Next Meeting St Louis, Mo, Nov 13 16, 1950

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St, Philadelphia Pa
Vice President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore Pa.
Treasurer Dr Harry P Schenck, 1912 Spruce St, Philadelphia, Pa
Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave, Philadelphia 18, Pa

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Reinaldo de Villiers
Vicepresidente Dr César Cabrera Calderin
Secretario Dr José Xirau
Tesorero Dr Alfredo M Petit.
Vocal Dr José Gross
Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice-Presidente Dr Luis E Olsen
Secretario Dr Eugenio Romero Díaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez, Dr Nondier Asis R Dr Jorge Bergallo Yofre

BUENOS AIRES CLUB OTORINOLARINGOLOGICO

Presidente Dr Juan Manuel Tato
Vice Presidente Dr Norberto Von Soubiron
Secretario Dr Oreste E Bergaglio
Pro-Secretario Dr Carlos A Gutierrez
Tesorero Dr Vicente R Carri
Pro Tesorero Dr Jorge Couzo

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman Dr Alston Callahan, 908 S 20th St. Birmingham, Ala
Chairman Elect Dr Francis LeJeune, Ochsner Clinic, New Orleans, La
Vice Chairman Dr Edwin Broyles, 1100 N Charles St, Baltimore Md
Secretary Dr Edley H Jones, 1301 Washington St Vicksburg, Miss

Next Meeting St Louis Mo Nov 13 16, 1950

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY

President Dr M Valentine Miller, 114 W Phil Ellen St., Philadelphia Pa
Vice-President Dr Thomas F Furlong, Jr, 36 Parking Plaza, Ardmore Pa.
Treasurer Dr Harry P Schenck, 1912 Spruce St., Philadelphia, Pa
Secretary Dr William J Hitschler, 5 E Chestnut Hill Ave Philadelphia 18, Pa.

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA

Presidente Dr Reinaldo de Villiers
Vicepresidente Dr César Cabrera Calderin
Secretario Dr José Xirau
Tesorero Dr Alfredo M Petit
Vocal Dr José Gross
Vocal Dr Pedro Hernández Gonzalo

ASSOCIACAO MEDICA DO INSTITUTO PENIDO BURNIER—CAMPINAS

President Dr Joao Penido Burnier
First Secretary Dr Gabriel Porto
Second Secretary Dr Roberto Barbosa
Librarian Treasurer Dr Leoncio de Souza Queiroz
Editors for the Archives of the Society Dr Guedes de Melo Filho Dr F J Monteiro Sales and Dr Jose Martins Rocha

SOCIEDAD DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOSCOPIA DE CORDOBA

Presidente Dr Aldo Remorino
Vice-Presidente Dr Luis E Olsen
Secretario Dr Eugenio Romero Díaz
Tesorero Dr Juan Manuel Pradales
Vocales Dr Osvaldo Suárez, Dr Nondier Asís R Dr Jorge Bergallo Yofre

BUENOS AIRES CLUB OTORINOLARINGOLOGICO

Presidente Dr Juan Manuel Tato
Vice Presidente Dr Norberto Von Soubiron
Secretario Dr Oreste E Bergaglio
Pro Secretario Dr Carlos A Gutierrez
Tesorero Dr Vicente R Carri
Pro-Tesorero Dr Jorge Couzo

INDEX

A

Abscesses of the Retropharyngeal Spaces in Adults, — Davidson Morris 1146

Allergy Bacterial and the Importance of Otolaryngological Procedures —Hansen Pruss O C 540

A Method for Improvement of the Curved Nasal Tip — Sheehan J E, and Swanker W A 680

A New Speculum for Septal Surgery,—Klaff D D. 75

Anesthesia in Adult Tonsillectomy The Use of Sodium Pentothal —Blaisdell Irl H. 721

Aphonia Psychosomatic and Ephemeral Adductor Paralysis —Jackson, C 1287

A Simplified Method of Obliterating Frontal Bone Defects — Lierle D M and Huffman W C 61

Atresia Congenital Choanal Surgical Repair of —Sheehan J E and Swanker W A........1320

Audiometry Setup for the Otologist s Office Two-Room —Work W P 454

Aureomycin in Penicillin Resistant Acute Otitis Media — Thumim M........ 1133

Autonomic Dysfunction in the Inner Ear —Hilger J A 1

B

Bacterial Allergy and the Importance of Otolaryngological Procedures —Hansen Pruss O C.... 540

Bell s Palsy The Nature of —Hilger J A........ 228

Bibliography A of Fenestration of the Labyrinth as of Dec 31 1946 Additions up to the Closing of the Original Bibliography —Kelemen Geo 200

Bifid Epiglottis Report of a Case —Montreuil F 194

Blue Scleras The Incidence (and Degrees) of in Otosclerosis and Other Ear Disorders —Fowler E P 406

Bone Conduction Audiometry Clinical Reliability of —Carhart R. and Hayes C........1084

Bronchoscopy and Esophagoscopy Use of Alnico Magnet in —Laff H I 186

C

Canal Persistent Craniopharyngeal in a Living Adult —Wilkerson W W Jr and Cayce L F........ 381

Cancer of the Face Treatment and Plastic Repair —New G B 731

Cancer of the Nose Treatment and Plastic Repair —Erich, J B 839

Carcinoma of the Larynx Management of —Orton H B........ 315

Carcinoma of the Larynx Treatment of A Statistical Study of Results —Cody C C Jr........ 621

Cardiovascular Epistaxis and the Naso-Nasopharyngeal Plexus — Woodruff G H 1238

Carotid Pain —Hilger J A........ 829

Child Transitional Cell Carcinoma of the Nasopharynx in a, —Grotts B F........1355

Chronic Secretory Otitis Media — Jordan Ray........1002

Clinical Studies of Vonecidin — Davis J C 272

Comparisons for the Thresholds for Speech Word and Sentence Tests Receiver vs Field and Monaural vs Binaural Listening —Breakey M R and Davis H 236

Continuous Pharyngeal Suction During Tonsillectomy Under Local Anesthesia,—Ruddy, L W 790

D

Demerol Hyoscine Analgesia, Edema of the Uvula Following,—Moorman, V R, and Birenboim, I M 66

Detection of Noise Susceptible Ears,—Wheeler, D E 1328

Dr Thomas Willis (1621 1675) A Great Seventeenth Century English Anatomist and Clinician Who Anticipated Many Modern Discoveries,—Wells, W A 287

Dramamine, The Effectiveness of, in Relieving the Vestibular Reactions Following the Labyrinthine Fenestration Operation,—Campbell, E H 1261

Dysphagia and Extraesophageal Pathology A Clinical Review of Some of the Important Surgical Lesions from the Endoscopic Viewpoint,—Hart, V K 771

E

Ear, The Human Ear as an Analyzer of Sound,—Sullivan, J A, *Gotlieb, C C, and Hodges, W E* 764

Ear, Nose and Throat, Psychosomatic Aspects of Diseases of the,—Coleman, L L 709

Ears Noise Susceptible, Detection of—Wheeler, D E 1328

Edema of the Uvula Following Demerol Hyoscine Analgesia —Moorman, V R, and Birenboim I M 66

Endaural Surgery of the Temporal Bone—Swanson, C A 984

Endoscopy Topical Anesthesia in A Critical Evaluation with Case Reports and Survey of Current Opinion—Himalstein M R 1102

Epicerebellar Subdural Hygroma,—Stamm C 1135

Epistaxis,—Ogura, J H, and Senturia B H 743

Epistaxis, Cardiovascular, and the Naso Nasopharyngeal Plexus,—Woodruff, G H 1238

Esophageal Lesions in Diffuse Scleroderma,—Lindsay, J R 83

Esophageal Stricture New Method of Threading,—Rubin H J 1361

Esophageal Varices and Their Treatment by Injection,—Tolan, J F 425

F

Face, Cancer of the and Plastic Repair,—New, G B 731

Facial Canal, Natural Absence of *Part of the Bony Wall of the*,—Guild, S R 668

Fenestration of the Labyrinth, A Bibliography as of Dec 31 1946 Additions Up to Closing Date of the Original Bibliography —Kelemen, G 200

Fenestration Operation, The—Indications — Technique and Results—Farrior, J B 516

Franciscus Sylvius (Francois de le Boe) 1614 1672 Founder of Iatro Chemistry, a Great Teacher of Medicine and Rightful Father of the Sylvian Eponyms,—Wells, W A 901

Frontal Bone Defects A Simplified Method of Obliterating —Lierle, D M, and *Huffman* W C 61

Further Statistical Study of Auditory Tests in Relation to the Fenestration Operation,—Thurlow, W R, *Davis, H Silverman, S R, and Walsh T E* 113

G

Gland, Parotid Tumors of the —Buxton R W, Maxwell J H and *Cooper D R* 565

H

Hearing Impairment in Children Surgical Procedures Directed Toward the Prevention of —Meltzer P E 1225

Hearing Loss Lightning as a Cause of—West G B Jr 1350

Hearing Tests and Testing —Guild S R 674

Hemangioma of the Lateral Band of the Pharynx and Nasopharynx Case Report—Wilkerson W W Jr and Cayce L F 1339

Hematology — Shea J J and Shea J J Jr 693

Hemostasis in Otolaryngology The Use of Thrombin and Absorbable Sponge for—Senturia B H Ogura J H and Walsh T E 1068

Herpes Laryngis Report of a Case of — Moffett D B and McFarland J J 69

Hydrops of the Labyrinth Case Report Coagulation Operation Clinical Course and Histopathology—Day K M and Lindsay J R 213

Hygroma Epicerebellar Subdural —Stamm C 1135

I

Idiopathic Supraorbital Neuralgia —Beyer T E 1273

Inner Ear Autonomic Dysfunction in the—Hilger J A 1

Irradiation Therapy of Fenestration and Radical Mastoidectomy Cavities —Proud G O N and Walsh T E 1255

L

Labyrinthine Surgery for Ménière s Disease—Lindsay J R. 22

Larynx Paralysis of the Following a Prophylactic Injection of Tetanus Antitoxin—Dintenfass H 369

Larynx Solitary Neurofibroma of the Larynx Report of Two Cases — Fisher G E and Odess J S 1345

Larynx Trachea and Bronchi Scleroma of the—Miller A H 506

Lightning as a Cause of Hearing Loss—West G B Jr 1350

Lingual Tonsils (A New Evaluation)—Elfman L K 1016

Local Resection of Carcinoma of Right Main Bronchus—Broyles E N and Rienhoff W F Jr 666

M

Macrocheilia—Garfin S W 48

Magnet The Use of the in the Tracheobronchial Tree the Stomach Esophagus and Duodenum—Equen M Roach G and Brown R 873

Management of Carcinoma of the Larynx—Orton H B 315

Ménière s Disease Labyrinthine Surgery for—Lindsay J R 22

Ménière s Disease The Surgical Treatment of—Altmann F 1045

Meningitis Following Nasal Polypectomy—Simonton K M and Anthony W P 169

Minor Salivary Gland Tumors in Respiratory Tract and Ear Review of the Literature and Report of Two Cases—Owens H 960

N

Nasal Mucus The Dynamics of—Tremble G E 639

Nasal Polypectomy Meningitis Following — Simonton K M and Anthony W P 169

Nasal Tip, Curved, A Method for Improvement of the,—Sheehan J E, and Swanker, W A 680

Natural Absence of Part of the Bony Wall of the Facial Canal, —Guild, S R 668

Neuralgia Idiopathic Supraorbital, —Beyer, T E 1273

New Method of Threading an Esophageal Stricture,—Rubin, H J 1361

Nose Cancer of the Treatment and Plastic Repair,—Erich, J B 839

Nose Drop Preparations, The Central Stimulant Action of Some Commercial,—McPhail, M K 278

O

Oropharynx and Nasal Passages Viruses in the—Enders, J F 372

Otitis Media Acute, Aureomycin in Penicillin Resistant, — Thumim, M 1133

Otitis Media, Acute, Two Cases of Acute Diffuse Labyrinthitis Following,—Rosenwasser H 345

Otitis Media Chronic Secretory,—Jordan R 1002

Otitis Media, Chronic, The Treatment of, with Glycerite of Hydrogen Peroxide, — Owens W E 1030

Otitis Media, Serous, The Rôle of Virus Infections in the Etiology of—Tobey, H G 35

Otolaryngology What Are Its Restrictions and Where Are Its Borderlines?,—Lederer, F L 469

Otosclerosis The Fenestration Operation for, — Woodman De Graaf 1299

P

Paracentesis, Ventilation for the Relief of Stubborn Eustachian Tube Blockage — McLaurin J G 482

Paralysis, Ephemeral Adductor and Psychosomatic Aphonia, — Jackson, C 1287

Paralysis of the Larynx Following a Prophylactic Injection of Tetanus Antitoxin,—Dintenfass, H 369

Pathology, Dysphagia and Extraesophageal A Clinical Review of Some of the Important Surgical Lesions from the Endoscopic Viewpoint,—Hart, V K 771

Persistent Craniopharyngeal Canal in a Living Adult,—Wilkerson, W W, Jr, and Cayce, L F 381

Pharynx and Nasopharynx Hemangioma of the Lateral Band of the Case Report — Wilkerson W W, Jr, and Cayce, L F 1339

Pharynx and Pharyngeal Surgery, Review of the Available Literature for 1948 in the,—LeJeune F E, and Stuart, R E 1177

Poliomyelitis, The Problems of Tonsillectomy and Tracheotomy in Relation to,—Wesselhoeft, C 726

Poliomyelitis, The Rôle of the Upper Respiratory Mucous Membrane in the Pathogenesis of — Aycock W L 335

Poliomyelitis Tonsillectomy Survey—1948,—Cunning, D S 441

Postnasal Discharge, — Bryant, B L 397

Postoperative Tonsil Bleeding Studies of the Etiology, Prevention and Management — Preston H G 251

Potential Hazards from Radiation Treatment of Hypertrophied Lymphoid Tissue in the Nasopharynx,—Robbins, L L and Schulz M D 147

Practical Aspects of Labyrinthine Tests — Hoople G H 12

Psychosomatic Aphonia and Ephemeral Adductor Paralysis — Jackson C 1287

Psychosomatic Aspects of Disease of the Ear Nose and Throat.—Coleman L L. 709

R

Radium in the Middle Ear The Use of for Selected Cases of Chronic Otitis Media —Wilkerson W W., Jr Cayce L F and Ivie J McK 1248

Rational Treatment of Tracheal Foreign Body with Case Report —Cutler H. M 1142

Reconstruction of the Nasal Septum —Lierle D M and Huffman, W C 858

Repair of the Septal Perforation a Rhinologic Problem A Rhinoplastic Approach (Author's Technique) —Seeley R. C 130

Report of a Case of Herpes Laryngis —Moffett, D B., and McFarland J J 69

Rhinitis Atrophic Scleroma Simulating Clinical Differentiation and Laboratory Confirmation —Wexler M R 1026

Rhinology in Children Resumé of and Comments on the Literature for 1948 —Wishart D E S 929

Rupture Subcutaneous of Trachea from Larynx by External Trauma with Stenosis and Recovery —Dysart B R 502

S

Scleroderma Esophageal Lesions in Diffuse —Lindsay J R. 83

Scleroma of the Larynx, Trachea and Bronchi —Miller A H 506

Scleroma Simulating Atrophic Rhinitis Clinical Differentiation and Laboratory Confirmation —Wexler M R 1026

Septal Perforation Repair of the a Rhinologic Problem. A Rhinoplastic Approach (Author's Technique) —Seeley R. C 130

Septal Surgery A New Speculum for —Klaff D D 75

Sinusitis and Hearing Loss The Relationship of Swimming and Diving to —Hitschler W J 799

Sinusitis The Importance of in Allergic Manifestations —Grove R C 653

Solitary Neurofibroma of the Larynx. Report of Two Cases —Fisher G E and Odess J S 1345

Stapedioparalytic Phonophobia (Hyperacusis) in a Deaf Ear Case Reports Including Studies on the Analysis of the Phenomenon and Suggestions for Possible Applications of the Phonophobia Test —Tschiassny K 886

Streptomycin in Otolaryngic Tuberculosis —Vadala Col A. J 156

Subcutaneous Rupture of Trachea from Larynx by External Trauma with Stenosis and Recovery —Dysart B R. 502

Suction Continuous Pharyngeal During Tonsillectomy Under Local Anesthesia —Ruddy L W 790

Surgical Procedures Directed Toward the Prevention of Hearing Impairment —Meltzer P E 1225

Surgical Repair of Congenital Choanal Atresia. — Sheehan J E. and Swanker W A 1320

Surgical Treatment of Ménière's Disease —Altmann, F 1045

Swimming and Diving The Relationship of to Sinusitis and Hearing Loss —Hitschler W J 799

T

Temporal Bone Endaural Surgery of the —Swanson C A 984

Tersavin The Effect of the L Ephedrine Salt of Penicillin G on the Bacterial Flora of the Nasal Mucosa — Grunberg E. and Titsworth, E H 263

Tests, Labyrinthine, Practical Aspects of,—Hoople, G H 12

The Central Stimulant Action of Some Commercial Nose Drop Preparations,—McPhail, M K 278

The Dynamics of Nasal Mucus,—Tremble, G E 639

The Effectiveness of Diamamine in Relieving the Vestibular Reactions Following the Labyrinthine Fenestration Operation —Campbell, E H 1261

The Effect of the L-Ephedrine Salt of Penicillin G (Tersavin) on the Bacterial Flora of the Nasal Mucosa — Grunberg, E, and Titsworth, E H 263

The Fenestration Operation for Otosclerosis, — Woodman De Graaf 1299

The Fenestration Operation—Indications, Technique and Results, —Farrior, J B 515

The Future of Our Specialty, — McCart, H 417

The Human Ear as an Analyzer of Sound,—Sullivan, J A, Gotlieb, C C, and Hodges W E 764

The Importance of Sinusitis in Allergic Manifestations, — Grove, R C 653

The Incidence (and Degrees) of Blue Scleras in Otosclerosis and Other Ear Disorders —Fowler E P 406

The Nature of Bell's Palsy—Hilger, J A 228

The Problems of Tonsillectomy and Tracheotomy in Relation to Poliomyelitis—Wesselhoeft C 726

The Relationship of Swimming and Diving to Sinusitis and Hearing Loss,—Hitschler, W J 799

The Rôle of the Upper Respiratory Mucous Membrane in the Pathogenesis of Poliomyelitis,—Aycock W L 335

The Rôle of Virus Infections in the Etiology of Serous Otitis Media,—Tobey, H G 35

The Treatment of Chronic Otitis Media with Glycerite of Hydrogen Peroxide,—Owen W E 1030

The Use of the Magnet in the Tracheobronchial Tree the Esophagus, Stomach and Duodenum —Equen M, Roach G and Brown, R 873

The Use of Radium in the Middle Ear for Selected Cases of Chronic Otitis Media —Wilkerson, W W, Jr, Cayce, L F and Ivie, J McK 1248

The Use of Sodium Pentothal Anesthesia in Adult Tonsillectomy, —Blaisdell, I H 721

The Use of Thrombin and Absorbable Sponge for Hemostasis in Otolaryngology — Senturia B H, Ogura J H, and Walsh, T E 1068

Tonsil Bleeding, Postoperative Studies of the Etiology Prevention and Management —Preston H G 251

Topical Anesthesia in Endoscopy A Critical Evaluation with Case Reports and Survey of Current Opinion —Himalstein M R 1102

Tracheal Obstruction — Norris C M 595

Transitional Cell Carcinoma of the Nasopharynx in a Child — Grotts B F 1355

Treatment of Carcinoma of the *Larynx A Statistical Study of* Results —Cody, C C, Jr 621

Tuberculosis, Streptomycin in *Otolaryngic,—Vadala Col A J* 156

Tumors Minor Salivary Gland in Respiratory Tract and Ear Review of the Literature and Report of Two Cases —Owens H 960

Tumors of the Parotid Gland — Buxton, R W Maxwell J H and Cooper, D R 565

Two Cases of Acute Diffuse Labyrinthitis Following Acute Otitis Media—Rosenwasser H 345

Two-Room Audiometry Setup for the Otologist's Office — Work W P 454

U

Use of Alnico Magnet in Bronchoscopy and Esophagoscopy — Laff H L 186

V

Vestibular Disturbances — Jones L H 354

Ventilation Paracentesis for the Relief of Stubborn Eustachian Tube Blockage—McLaurin J G 482

Viruses in the Oropharynx and Nasal Passages—Enders J F 372

Vonecidin Clinical Studies of — Davis J C 272

AUTHORS

A

ALDEN A M and DAVIDSON M—Recurrent Pneumococcus Meningitis Report of a Case 1276

ALTMANN F—Surgical Treatment of Ménière's Disease 1045

ANTHONY, W P and SIMONTON K M—Meningitis Following Nasal Polypectomy 169

AYCOCK W L—The Rôle of the Upper Respiratory Mucous Membrane in the Pathogenesis of Poliomyelitis 335

B

BEYER T E—Idiopathic Supraorbital Neuralgia. 1273

BIRENBOIM I M and MOORMAN V R—Edema of the Uvula Following Demerol Hyoscine Analgesia 66

BLAISDELL I H —The Use of Sodium Pentothal Anesthesia in Adult Tonsillectomy 721

BREAKEY M R and DAVIS H—Comparisons for the Thresholds for Speech Word and Sentence Tests, Receiver vs Field and Monaural vs Binaural Listening 236

BROWN R EQUEN M and ROACH G—The Use of the Magnet in the Tracheobronchial Tree the Esophagus Stomach and Duodenum 873

BROYLES E N and RIENHOFF W F Jr—Local Resection of Carcinoma of the Right Main Bronchus 666

BRYANT B L — Postnasal Discharge 397

BUXTON R W MAXWELL J H and COOPER D R —Tumors of the Parotid Gland 565

C

CAMPBELL E H —The Effectiveness of Dramamine in Relieving the Vestibular Reactions Following the Labyrinthine Fenestration Operation 1261

CARHART R and HAYES C—Clinical Reliability of Bone Conduction Audiometry 1084

CANCE, L F and WILKERSON W W Jr —Persistent Craniopharyngeal Canal in a Living Adult 381

CANCE L F WILKERSON W W JR and IVIE J McK—The Use of Radium in the Middle Ear for Selected Cases of Chronic Otitis Media 1248

CANCE L F and WILKERSON W W Jr — Hemangioma of the Lateral Band of the Pharynx and Nasopharynx Case Report 1339

CODY C C JR—Treatment of Carcinoma of the Larynx A Statistical Study of Results 621

Coleman, L L — Psychosomatic Aspects of Diseases of the Ear, Nose and Throat ... 709

Cooper, D R, Buxton, R W, and Maxwell, J H—Tumors of the Parotid Gland ... 565

Cunning, D S—Poliomyelit's Tonsillectomy Survey—1948 ... 441

Cutler, H M — Rational Treatment of Tracheal Fore'gn Body with Case Report ... 1142

D

Davidson, M — Abscesses of the Retropharyngeal Spaces in Adults ... 1146

Davidson, M, and Alden, A M—Recurrent Pneumococcus Meningitis Report of a Case ... 1276

Davis, H, Thurlow, W R Silverman, S R, and Walsh T E—Further Statistical Study of Auditory Tests in Relation to the Fenestration Operation ... 113

Davis, H, and Breakey M R — Comparison for the Thresholds of Speech, Word and Sentence Tests, Receiver vs Field and Monaural vs Binaural Listening ... 236

Davis J C—Clinical Studies of Vonecidin ... 272

Day, K M, and Lindsay J R—Hydrops of the Labyrinth Case Report Coagulation Operation Clinical Course and Histopathology ... 213

Dintenfass, H—Paralysis of the Larynx Following a Prophylactic Injection of Tetanus Antitoxin ... 369

Dysart, B R — Subucutaneous Rupture of Trachea from Larynx by External Trauma with Stenosis and Recovery ... 502

E

Elfman, L K—Lingual Tonsils (A New Evaluation) ... 1016

Enders, J F—Viruses in the Oropharynx and Nasal Passages ... 372

Equen, M, Roach, G, and Brown, R—The Use of the Magnet in the Tracheobronchial Tree, the Esophagus, Stomach and Duodenum ... 873

Erich, J B—Cancer of the Nose Treatment and Plastic Repair ... 839

F

Farrior, J B—The Fenestration Operation — Ind cations, Technique and Results ... 515

Fisher, G E, and Odess, J S—Solitary Neurofibroma of the Larynx Report of Two Cases ... 1345

Fowler, E P — The Incidence (and Degree) of Blue Scleras in Otosclerosis and Other Ear Disorders ... 406

G

Garfin, S W—Macrocheilia ... 48

Gotlieb, C C, Sullivan J A., and Hodges, W E—The Human Ear as an Analyzer of Sound ... 764

Grotts, B F—Transitional Cell Carcinoma of the Nasopharynx in a Child ... 1355

Grove, R C—The Importance of Sinusitis in Allergic Manifestations ... 653

Grunberg, E, and Titsworth, E H—The Effect of the L-Ephedrine Salt of Penicillin G (Tersavin) on the Bacterial Flora of the Nasal Mucosa ... 263

Guild, S R—Hearing Tests and Testing ... 674

Guild, S R—Natural Absence of Part of the Bony Wall of the Facial Canal ... 663

H

Hart, V K—Dysphagia and Extraesophageal Pathology A Clinical Review of Some of the Important Surgical Lesions from the Endoscopic Viewpoint ... 771

Hayes C, and Carhart R—Clinical Reliability of Bone Conduction Audiometry 1064

Hilger, J A—Autonomic Dysfunction in the Inner Ear 1

Hilger, J A.—Carotid Pain 829

Hilger, J A—The Nature of Bell s Palsy 228

Himalstein, M R.—Topical Anesthesia in Endoscopy A Clinical Evaluation with Case Reports and Survey of Current Opinion.. 1102

Hitschler W J—The Relationship of Swimming and Diving to Sinusitis and Hearing Loss 799

Hodges W E Sullivan, J A and Gotlieb, C C—The Human Ear as an Analyzer of Sound 764

Hoople, G H—Practical Aspects of Labyrinthine Tests 12

Huffman, W C and Lierle, D M—A Simplified Method of Obliterating Frontal Bone Defects 61

Huffman, W C and Lierle, D M—Reconstruction of the Nasal Septum 858

I

Ivie, J McK, Wilkerson W W Jr and Cayce, L F—The Use of Radium in the Middle Ear for Selected Cases of Chronic Otitis Media 1248

J

Jackson C—Psychosomatic Aphonia and Ephemeral Adductor Paralysis 1287

Jones I H—Vestibular Disturbances 354

Jordan R—Chronic Secretory Otitis Media 1002

K

Kelemen, G—Fenestration of the Labyrinth A Bibliography as of Dec 31, 1946 Additions Up to the Closing Date of Original Bibliography 200

Klaff D D—A New Speculum for Septum Surgery 75

L

Laff H I—Use of Alnico Magnet in Bronchoscopy and Esophagoscopy 186

Lederer F L—Otolaryngology What Are Its Restrictions and Where Are Its Borderlines? 469

LeJeune F E and Stuart R E—Review of Available Literature on the Pharynx and Pharyngeal Surgery for 1948 1177

Lierle, D M and Huffman W C—A Simplified Method of Obliterating Frontal Bone Defects 61

Lierle, D M and Huffman W C—Reconstruction of the Nasal Septum 858

Lindsay J R—Esophageal Lesions in Diffuse Scleroderma 83

Lindsay J R, and Day, K M—Hydrops of the Labyrinth Case Report Coagulation Operation Clinical Course and Histopathology 213

Lindsay J R—Labyrinthine Surgery for Ménière s Disease 22

M

McCart H—The Future of Our Specialty 417

McFarland J J and Moffett D B—Report of a Case of Herpes Laryngis 69

McLaurin J G—Ventilation Paracentesis for the Relief of Stubborn Eustachian Tube Blockage 482

McPhail, M K — The Central Stimulant Action of Some Commercial Nose Drop Preparations 278

Maxwell J H, Buxton R W, and Cooper D R — Tumors of the Parotid Gland 565

Meltzer P E — Surgical Procedures Directed Toward the Prevention of Hearing Impairment in Children 1225

Miller A H — Scleroma of the Larynx, Trachea and Bronchi 506

Moffett D B, and McFarland, J J — Report of a Case of Herpes Laryngis 69

Montreuil, F — Bifid Epiglottis Report of a Case 191

Moorman, V R, and Birnbaum I M — Edema of the Uvula Following Demerol Hyoscine Analgesia 66

N

New, Gordon B — Cancer of the Face, Treatment and Plastic Repair 731

Norris, C M — Tracheal Obstruction 595

O

Odess J S, and Fisher G E — Solitary Neurofibroma of the Larynx Report of Two Cases .. 1345

Ogura, J H, and Senturia B H — Epistaxis 743

Ogura J H, Senturia, B H and Walsh T E — The Use of Thrombin and Absorbable Sponge for Hemostasis in Otolaryngology 1068

Orton, H B — Management of Carcinoma of the Larynx 315

Owens H — Minor Salivary Gland Tumors in Respiratory Tract and Ear Review of the Literature and Report of Two Cases 960

Owen W E — The Treatment of Chronic Purulent Otitis Media with Glycerite of Hydrogen Peroxide .. 1030

P

Preston H G — Postoperative Tonsil Bleeding Studies of the Etiology, Prevention and Management 251

Proud G O'N, and Walsh, T E — Irradiation Therapy of Fenestration and Radical Mastoidectomy Cavities 356

R

Rienhoff, W F, Jr, and Broyles, E N — Local Resection of Carcinoma of the Right Main Bronchus 666

Roach, G, Equen, M, and Brown, R — The Use of the Magnet in the Tracheobronchial Tree, the Esophagus, Stomach and Duodenum 873

Rosenwasser H — Two Cases of Acute Diffuse Labyrinthitis Following Acute Otitis Media 345

Rubin H — New Method of Threading an Esophageal Stricture 1361

Ruddy L W — Continuous Pharyngeal Suction During Tonsillectomy Under Local Anesthesia 790

S

Seeley R C — Repair of the Septal Perforation A Rhinologic Problem A Rhinoplastic Approach (Author's Technique) 130

Senturia, B H, and Ogura J H Epistaxis 743

Senturia B H, Ogura J H, and Walsh T E — The Use of Thrombin and Absorbable Sponge for Hemostasis in Otolaryngology 1068

Shea J J and Shea J J, Jr — Hematology 693

Sheehan J E and Swanker W A—A Method for Improvement of the Curved Nasal Tip — 680

Sheehan J E and Swanker W A—Surgical Repair of Congenital Choanal Atresia — 1320

Silverman S R, Walsh T E, Thurlow W R, and Davis H—Further Statistical Study of Auditory Tests in Relation to the Fenestration Operation — 113

Simonton K M, and Anthony P—Meningitis Following Nasal Polypectomy — 169

Stamm C—Epicerebellar Subdural Hygroma — 1175

Stuart R E, and LeJeune F E—Review of Available Literature on the Pharynx and Pharyngeal Surgery for 1948 — 1177

Sullivan J A, Gotlieb C C, and Hodges W E—The Human Ear as an Analyzer of Sound — 764

Swanker W A, and Sheehan J E—A Method for Improvement of the Curved Nasal Tip — 680

Swanker W A, and Sheehan J E—Surgical Repair of Congenital Choanal Atresia — 1320

Swanson C A—Endaural Surgery of the Temporal Bone — 985

T

Thumim M—Aureomycin in Penicillin Resistant Acute Otitis Media — 1132

Thurlow W R, Davis H, Silverman S R, and Walsh T E—Further Statistical Study of Auditory Tests in Relation to the Fenestration Operation — 113

Titsworth E H, and Grunberg E—The Effect of the L-Ephedrine Salt of Penicillin G (Tersavin) on the Bacterial Flora of the Nasal Mucosa — 262

Toth H G—The Rôle of Virus Infections in the Etiology of Serous Otitis Media — [illegible]

Tolan J F—Esophageal Varices and Their Treatment by Injection — [illegible]

Tremble G E—The Dynamics of Nasal Mucus — [illegible]

Tschiassny K—Stapedioparalytic Phonophobia (Hyperacusis) in a Deaf Ear Case Reports Including Studies on the Analysis of the Phenomenon and Suggestions for Possible Applications of the Phonophobia Test — 556

V

Vadala Col A J—Streptomycin in Otolaryngic Tuberculosis — 175

W

Walsh T E, Thurlow W R, Davis H, and Silverman S R—Further Statistical Study of Auditory Tests in Relation to the Fenestration Operation — 113

Walsh T E and Proud G O—Irradiation Therapy of Fenestration and Radical Mastoidectomy Cavities — 1255

Walsh T E, Senturia B H, and Ogura J H—The Use of Thrombin and Absorbable Sponge for Hemostasis in Otolaryngology — 1068

Wells W A—Franciscus Sylvius (Francois de le Boe) 1614 1672 Founder of Iatro Chemistry a Great Teacher of Medicine and Rightful Father of the Sylvian Eponyms — 904

Wells W A—Dr Thomas Willis (1621 1675) A Great Seventeenth Century English Anatomist and Clinician Who Anticipated many Modern Discoveries 287

Wesselhoeft C—The Problems of Tonsillectomy and Tracheotomy in Relation to Poliomyelitis 726

WEST, G B, JR—Lightning as a *Cause of Hearing Loss* *1350*

WEXLER, M R—Scleroma Simulating Atrophic Rhinitis Clinical Differentiation and Laboratory Confirmation 1026

WHEELER, D E — Detection of Noise Susceptible Ears 1328

WILKERSON W W JR and CAYCE L F—Hemangioma of the Lateral Band of the Pharynx and Nasopharynx Case Report 1339

WILKERSON, W W, JR, CAYCE, L F, and IVIE, J McK—The Use of Radium in the Middle Ear for Selected Cases of Chronic Otitis Media 1249

WILKERSON, W W, JR, and CAYCE L F—Persistent Craniopharyngeal Canal in a Living Adult 381

WISHART, D E S—Rhinology in Children Resumé of and Comments on the Literature for 1948 929

WOODMAN, DE GRAAF—The Fenestration Operation for Otosclerosis 1299

WOODRUFF, G H—Cardiovascular Epistaxis and the Naso Nasopharyngeal Plexus 1238

WORK, W P—Two-Room Audiometry Setup for the Otologist's Office 454

BOOK REVIEWS

CANFIELD N—Audiology 1366

GUGGENHEIM L—Phylogenesis of the Ear 203

NEFFSON, A. H—Acute Laryngotracheobronchitis 1366

New Gould Medical Dictionary 1368

SALTZMAN M — Clinical Audiology 1367

STEVENSON R. S—Recent Advances in Otolaryngology 1366